

Founded as Metal Industry, January, 1903
by Palmer H. Langdon, 1868-1935

L. H. LANGDON
President-Treasurer

PALMER H. LANGDON, Publisher
THOMAS A. TRUMBOUR, General Manager
JOAN T. WIARDA, Sales Manager
NATHANIEL HALL, Technical Editor
FRED A. HERR, Pacific Coast Editor
JOHN E. TRUMBOUR, Equipment & News Editor
INEZ OQUENDO, Assistant Editor

Published Monthly by
FINISHING PUBLICATIONS, INC.

Serving the electroplating and industrial coating fields with specialized monthlies and guidebooks since 1903. Companion publication, ORGANIC FINISHING.

381 Broadway
Westwood, N. J.
WEstwood 5-1530

Branch Offices

Los Angeles 14, California
742 South Hill Street
MAdison 6-5421

Hornell, N. Y.
19 Elmwood Place
Hornell 943

Member



Business Publications
Audit



National Business
Publications



Society of Business Magazine Editors

Devoted Exclusively to Metallic Surface Treatments

METAL FINISHING

APRIL, 1954

VOLUME 52 • NUMBER 4

Editorial — We'll Try To Help - - But!	55
Plating on Lead Alloys, Pewter and Britannia	56
By Joseph Haas	
Surface Treatment and Finishing of Light Metals — Part II	62
By Dr. S. Wernick and R. Pinner	
Metallizing with an Aqueous Platinic Chloride Solution	69
By Louis Silverman and Katherine Trego	
Bronze and Speculum Plates Provide Good Protection for Steel	70
By W. H. Safranek, W. G. Hespenheide and C. L. Faust	
Direct Titration of Zinc and Cadmium in Cyanide Solutions	74
By J. P. Leftin	
A Porosity Test for Electrodeposits on Zinc-Base Die-Castings	76
By H. K. Lutwak	

DEPARTMENTS

Shop Problems	80	Motor City Plating News	110
Abstracts	82	Manufacturers' Literature	114
Patents	85	Obituary	115
Recent Developments	90	Associations and Societies	115
Business Items	99	New Book	125
News from California	106	Letter to the Editor	126

COMING SOON

An attempt at summarizing, in reasonably simple form, the present state of knowledge of the structure of electrodeposits.

The history and development of plating in the automotive industry.

Ways and means for correcting bath temperature, which can be automatically maintained.

Stop-off materials and their use in hard chrome plating.

A digest of current Government finishing specifications.

SUBSCRIPTION INFORMATION

United States and Canada \$4.00 per year, other countries \$8.00. Single copies 45c in United States and Canada, other countries 85c. GUIDEBOOK-DIRECTORY 22nd edition 1954 current, 570 pages 5 1/4 x 7 7/8 \$3.00. A copy of this book is included with subscriptions. Please remit by check or money order; cash should be registered. Request for change of address should reach us on or before the 15th of the month preceding the issue with which it is to go in effect. In sending us your change of address, please be sure to send your old address as well as the new one. It is difficult and often impossible to supply back numbers. Copyright 1954 by Finishing Publications, Inc. All rights reserved. Contributed articles, letters on pertinent subjects are invited. Their publication, however, does not necessarily imply editorial endorsement. Re-entered as second class matter June 13, 1940 at the post office at New York, N. Y. under the Act of March 3, 1879.

*right! You don't need
buffing with Silver-Lume,
the really bright silver*

The sparkle on that silver is born in the plating bath, and it's the **FIRST** and **ONLY** *really bright* silver plating process. Coverage? H-VW-M's Silver-Lume Process produces a consistently uniform high color through an exceptionally wide current density range. Even deeply recessed pieces like the bowl of a gravy ladle come out of the bath uniformly bright. There's no need for special equipment to plate with Silver-Lume, initial cost is low, savings in buffing costs are considerable—and the whole process is easily controlled, foolproof and time-saving with **consistently** better results.

This exclusive process is just one of many results of over eighty years of constant electroplating development—a continuing policy summed up in H-VW-M Platemanship... your working guarantee of the best that industry has to offer—not only in the bright plating of silver—but in every phase of plating and polishing.

8463

Your H-VW-M combination—of the most modern testing and development laboratory—of over 80 years experience in every phase of plating and polishing—of a complete equipment, process and supply line for every need.

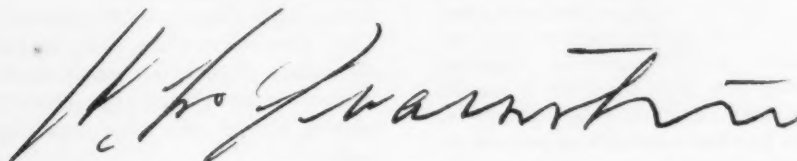
HANSON-VAN WINKLE-MUNNING CO., MATAWAN, N. J.
PLANTS AT: MATAWAN, N. J. • ANDERSON, INDIANA
SALES OFFICES: ANDERSON • BALTIMORE • BOSTON
CHICAGO • CLEVELAND • DAYTON • DETROIT • GRAND
RAPIDS • LOS ANGELES • LOUISVILLE • MATAWAN
MILWAUKEE • NEW YORK • PHILADELPHIA • PITTSBURGH
ROCHESTER • SPRINGFIELD (MASS.) • STRATFORD (CONN.)
UTICA • WALLINGFORD (CONN.)

H-VW-M

INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

METAL FINISHING

We'll Try to Help -- But!



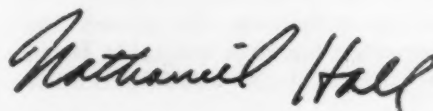
An important part of METAL FINISHING's service to the industry has always been the supplying of information by mail to readers. We take pride in the assistance we are able to render our subscribers and we sometimes go to great lengths to obtain the information requested so, if there is a problem or a question to be answered, by all means drop us a line.

First, however, we would like to remove any impression that one must wait for the answer to appear in the "Shop Problems" section. Letters are answered as soon as the required information is obtained. Of the many hundreds of inquiries received each year only a few are published, which we think might be of interest to our readers.

We do not insist that your inquiry be typewritten or on your firm's letterhead. If you don't want the boss to know, write us from home but, please write clearly, keeping in mind that, although you can read your own handwriting, perhaps the editor cannot. A glance at the signature of a recent inquirer, reproduced above, will indicate what we mean. We do not ask you to include a stamped and self-addressed envelope with your letter but don't forget to put your address down. It is surprising how often this little matter is ignored. After all, your name and street address will not insure an early reply if the city is omitted.

As to the subject matter of the inquiry, it should be obvious that the more information supplied concerning a problem, the more complete and helpful the answer. Yet we have received a letter stating only that the writer was having trouble with his anodizing and asking for suggestions. Not much to go by, it must be admitted! The editor shouldn't be expected to advise which bright nickel is the best on the market. Or, what is almost as difficult to answer, a request for *all* information on a broad subject. On nickel, for example, our technical files contain about five hundred data cards alone.

We present these observations and suggestions not only because we are sincerely interested in hearing from our readers but because we are anxious lest we occasionally be accused of ignoring an inquiry or of being of no help. If these points are kept in mind when writing, you can help us to help you.



Plating on Lead Alloys, Pewter and Britannia

By Joseph Haas, *Industrial Engineer, Laboratory of Advanced Research, Remington-Rand, Inc., South Norwalk, Conn.*



Mr. Haas is one of the early pioneers in the plating industry, and has made many important contributions to its growth and development. A licensed Professional Engineer, he has had extensive experience in all phases of metal finishing as a foreman, consultant and factory manager in many of the leading plants in the country. He has been a contributor to the technical press

for many years, and had carried on a consulting practice for over 30 years.

THE object in writing this article is to present to the plating industry a thoroughly practical, simple and accurate method of plating any metal on lead, lead alloys; pewter and Britannia Metal.

A review of questions raised in the various trade journals reveals that there has been a long felt need by the industry for direct guidance and information in plating these metals. To date information has been scattered, indefinite, contradictory, and even regarded as trade secrets. This article will lay all the cards on the table — face up.

A Typical Problem

Trouble with chromium plate blistering on anti-monial lead handles and spouts attached to solid copper bodies is a typical example of the problem. The blisters appear particularly on those lead parts that have smooth surfaces. Another feature of the blistering is that the articles appear perfect when first removed from the chromium solution, but after standing about twenty-four hours, tiny blisters appear. These blisters appear on both high and low current density areas, predominating on the low current density areas.

The method of preparing the work for plating is as follows: (1) Soak-dip in mild cleaner, (2) Rinse, (3) Scratch brush lead attachments with a soft brush with running soap bark water, (4) Rinse, (5) Sponge complete article with warm mild alkali cleaner, (6) Rinse, (7) Rack and electroclean, cathodic, (8) Rinse, (9) 5% fluoboric acid dip, (10) Rinse, (11) Rinse, (12) High speed copper strike for 30-45 sec., (13) Rinse, (14) Rinse, (15) 5% sulphuric acid-5 sec., (16)

Rinse, (17) Bright nickel plate-8 min., (18) Rinse, (19) Chromium plate. Why is this blistering of the chromium plate being experienced, and what is the reason for its unusual appearance, that is, why do the blisters appear only after standing approximately 24 hours?

The writer has been confronted with this problem four times. Twice the problem arose with companies that were using a bright nickel before chromium plating, and had been producing satisfactory plating for a considerable period of time. The platers in charge knew their business, and experienced no difficulties, until management, in order to increase production, insisted on a change in procedure before the bright nickel plating.

The other two plants had been nickel plating their chromium work in a Watts solution, and then color buffing the nickel plate. They too had been experiencing no difficulty by this method. Then, along came an enterprising salesman and sold management on the idea of converting the Watts solution to a bright nickel, and saving the money spent on color-buffing the nickel plate. The salesman also laid out the plating cycle, and then the fun began. Needless to state, the fun in these cases was blisters also, but with the difference that if the parts were not blistered when removed from the bright nickel solution, then the blisters appeared upon removal from the chromium solution or a few hours later.

There is no question but that considerable difficulty is experienced with articles made entirely of lead, and with articles of copper, brass, nickel-silver soft soldered together with lead alloy attachments, as in holloware. Chromium plated articles give the most difficulty, but silver plated articles could stand considerable improvement in quality. It is not an uncommon occurrence for silver plated holloware, with only a few months of periodic use in a home, to have the silver plated lead alloy mounts show bare sections of lead, where the deposit has peeled off.

Lack of progressive thought and action together with inherent inertia plagues the plating and metal finishing industry, and are the basic reasons for the abovementioned difficulties and poor quality products, with most of the responsibility resting on the manufacturer.

Formerly, this much difficulty was not experienced in plating articles of this type. But cleaners have changed, high speed production methods have been adopted, bright nickel solutions, and chromium plating

have been added without full recognition of the character of the metal being plated.

Old and New Methods

It would not be out of place at this point to outline the manner in which buffed holloware and novelty items were plated before the advent of bright nickel and chromium solutions.

1. Wash out in kerosene; dry in sawdust.
2. Hot alkali soak, mop and scrub.
3. Water rinse.
4. Hot alkali immersion clean.
5. Water rinse.
6. Dip in 5% hydrochloric or sulphuric acid.
7. Water rinse.
8. Scour with watery pumice with a soft scratch brush or soft buff at slow speed (1200 R.P.M.)
9. Water rinse and sponge.
10. Hot weak alkali immersion clean.
11. Water rinse.
12. Cyanide dip.
13. Water rinse.
14. Copper cyanide plate.
15. Water rinse.
16. Nickel plate in a double nickel salt solution.*
17. Water rinse.
18. Silver strike.
19. Silver plate.

Attention is called to the fact that after scouring had been performed in operation #8, leaded articles did not come into contact with any acid again. This should be born in mind for later discussion in this article. There were different practices in various plants. In some, the work was scratch brushed with soap bark water after copper plating and before nickel plating. In other plants, the work was removed from the silver tanks when one-half of the silver was deposited, scratch brushed with soap bark water, and then returned to the silver tanks for the balance of the silver.

With chromium plating entering the picture, the sequence of operations followed as listed above through operation #16. After a one-half hour nickel plate:

17. Color-buff nickel.
18. Wipe clean with a soft cloth.
19. Immerse in 10% sulphuric acid.
20. Water rinse.
21. Chromium plate.

Whether the articles being plated are made entirely of lead alloy, or component parts of copper, brass, or nickel silver soft soldered together with antimonial lead attachments, the critical constituent we are dealing with is lead. Consequently, it is desirable that the chemistry of the metal (lead) to be cleaned and prepared for plating be considered and understood.

Factors To Be Understood

Lead is a very soft metal with a bluish white color and, when freshly colored or buffed, presents a bright metallic luster, which rapidly oxidizes and dulls after a short exposure to air. Antimony is added to lead (3-13%) to give it hardness and stiffness. It also aids,

*Later single nickel salt solution was used, but of low acidity, slightly acid to litmus paper; probably 5.8-6.2 in terms of pH.

because of its expanding properties upon solidifying, in preventing shrinkage of the castings so that, when the alloy is poured into a mold, the casting formed is a fine and sharp reproduction of the mold.

Antimony is a silvery white metal with a high metallic luster. It does not tarnish readily on exposure to air. Compared with lead, antimony is chemically inert and in no way contributes any difficulties in plating the alloy.

Pewter, properly, is an alloy of 85% tin and 15% lead, but some articles sold as pewter have been found to have a composition of: tin 79%, antimony 7%, bismuth 2% copper 2%, lead 10%.

Britannia Metal consists of 90% tin with varying amounts of antimony and with or without copper not to exceed 3%. Consequently, Britannia Metal may be considered principally tin hardened with antimony. However, alloys containing even lead, with antimony and copper are still classified as Britannia Metal, provided the tin content is 90%.

Tin is a white lustrous metal with a pale blue tinge. The metal retains its luster on exposure to air. It is soft, but harder than lead.

Most commercial cleaners attack lead rapidly, dissolving the metal, oxidizing it and, in addition, forming insoluble compounds. Assuming that commercial cleaners consist of mixtures selected from the following chemicals: sodium hydroxide, sodium carbonate, phosphate or polyphosphates, any of the many alkali silicates, some wetting agents, and possibly a sequestering agent, the chemistry indicates that cleaners containing carbonates, phosphates and silicates should be avoided in cleaning lead, antimonial lead, including solders, or that the necessary precaution be taken in subsequent operations to minimize their effect. Antimony is relatively unaffected by alkalies and, whatever attack on the metal alloy takes place, occurs on the lead and around the boundaries of the antimony crystals.

As tin is also readily attacked by alkalies, whatever is subsequently stated for the alkali cleaning of lead and its alloys applies equally for the preparation of pewter and Britannia Metal.

Besides the alkali cleaner used in preparing lead and its alloys for plating, there are acid dips. This is necessary to neutralize the alkali trapped in the pores of the metal which, if present, may precipitate basic salts on entry into the plating solution, resulting in blistering. Furthermore, the use of acid dips is important to neutralize the alkaline surface film on the metal which persists regardless of how thoroughly the metal parts are rinsed in water. It is well known that the adhesion of electrodeposits is lessened when a metal is deposited upon a highly alkaline surface from a slightly alkaline or acid solution.

Up to very recent years, sulphuric and hydrochloric acids have been used as the acid dips on lead, lead alloys, holloware having antimonial lead attachments, pewter and Britannia Metal in concentrations varying from 5-15%. Tin dissolves slowly in both dilute sulfuric and hydrochloric acids. But, inasmuch as both pewter and Britannia Metal contain lead, subsequent acid treatment recommended for lead, lead alloys, and holloware should be applied in preparing pewter and Britannia Metal for plating.

Dilute sulfuric and hydrochloric acids have little or no action on antimony, whereas both attack lead, forming a surface film of insoluble lead sulphate and chloride which, while protecting the lead from further attack, created the major difficulty or problem for the plater in years gone by. That was the reason why the platers, after scouring their articles with pumice, avoided those acids in subsequent processings. Today neither of these acids are used. Instead fluoboric acid has been substituted, and has been found to possess many advantages, particularly upon lead and lead alloys, with no detriment to accompanying copper, brass nickel silver components. Fluoboric acid will dissolve all the metal oxides that the plater may encounter and, in addition, silicate residues from silicate type cleaners. Finally, the acid and residual salts are readily rinsable leaving the metal with a chemically clean surface. Consequently, at least as far as preparing lead and lead alloys, holloware, pewter, Britannia Metal for plating, the plater should have no problem.

The fluoboric acid dip is made up to a strength of 10%, or 1 volume 42% fluoboric acid to 3 volumes of water. It is used at room temperature for 5-15 seconds. Frequently lead surfaces are slightly "burnt" by buffing (oxidized). In such cases it will be found advantageous to give the articles a 2-5 second anodic strike using lead cathodes.

But, as indicated by the problem which started off this article, the plater does have trouble plating lead, lead alloys, holloware with antimonial lead attachments, pewter and Britannia Metal. In none of the cases mentioned was cleaning or the acid dips the cause of the blistering encountered.

Before explaining what caused the blistering, we should become further acquainted with the full picture of the difficulties or factors involved in plating lead and lead alloys. Bearing in mind the very active chemical nature of lead and tin in alkali cleaners and, with the elimination of sulphuric and hydrochloric acids as a source of difficulty, we still have to consider the following factors: (1) The possibility of the formation of insoluble lead sulphate and chloride in current bright nickel solutions in use today, because of their low pH operation; (2) the low tensile strength of lead, and the too easy working of lead under pressure; (3) the fact that the coefficient of expansion of lead is much greater than that of any metals that are deposited upon it; (4) the absorptive affinity that lead has for copper, brass, silver, when these metals are applied directly to lead, especially if the metal deposits are too thin.

Buffing, Cleaning, Acid Dipping

Lead flows very easily when subjected to mechanical work, such as buffing. Because of this, deep pits and scratches cannot be removed by the customary buffing method, as with tripoli buffing flow marks become visible. Likewise, abrasive set-up wheels cannot be used because they load up quickly. The standard method of polishing lead alloys is by sand bobbing. The proper grade of greaseless compound may also be used for this purpose. The subsequent buffing is preferably done with a sheepskin or chamois buff, applying white compound to the wheel at a spindle speed not exceeding 1800 r.p.m. This method is far superior to buffing with

cotton wheels as it avoids dragging, and results in the lead alloy having a high luster.

Two difficulties are experienced in cleaning lead alloys. One is the attack of the lead by the alkali in the cleaner, and the other is the danger of the formation of insoluble lead soaps and other soaps with the surface active agents that may be in the cleaner. Not every cleaner is satisfactory for cleaning lead alloys. Nor should lead or lead alloys be cleaned in the same cycle of tanks with other metals.

To obtain consistently satisfactory quality work in plating lead alloys or articles with lead alloy attachments, buffing compounds should be removed by soaking in an emulsion cleaner, preferably with agitation and, if necessary, swabbing out lodged buffing compounds in the recesses, following with a warm water (130°-150°F.) rinse or spray. Or, the lodged buffing compounds in the recesses can be blown out with steam, which is an effective method. After immersion in a water dispersion rinse, the parts are additionally passed through a trichlorethylene degreaser through phases of hot soak, spray and vapor. The precleaning cycle outlined minimizes attack on lead alloys or lead alloy attachments, and discoloration of copper, brass, etc., bodies.

A proper alkali cleaner for lead alloys can be used as a soak or mopping cleaner but it is best used cathodically in low concentration and at 170°-180°F. since, with electrolytic cleaning, faster soil removal is obtained. However, the current density should be controlled and should not exceed 20 amps./sq. ft. Higher current densities create excessive alkalinity at the cathode, which causes increased attack upon the lead alloy. The cleaning time should be short, in the range of 10 seconds - 1 minute. Rinse thoroughly after cleaning, preferably in warm water (110°-120°F.).

Regarding anodic cleaning of lead and antimonial lead, or component parts with attachments of these metals, the writer cannot go along with it at all. It is both too uncertain and too dangerous. There should be no necessity for it, if the work is properly pre-cleaned, the proper alkali cleaner of the proper concentration used, and the cleaner changed often enough.

Success in plating upon lead alloys depends on the use of the correct acid dip. It has already been explained that the correct acid on lead alloys, etc. is fluoboric acid in a concentration of 10% by volume, at room temperature, 5-15 seconds. Fluoboric acid is suitable not only for lead alloys, but also for copper, brass, nickel-silver and steel. The acid is best kept in rubber lined, or polyethylene tanks. Frequent changing of the acid, together with keeping the surface of the acid clear of grease films is essential. After acid dipping, the articles are rinsed thoroughly in running cold water, and transferred to the subsequent plating solution.

Plating Lead Alloys

It is possible to obtain adherent nickel deposits directly on lead and lead alloys. After the fluoboric acid dip, and thorough rinsing, the work is transferred without delay to a warm, ductile nickel solution. Electric contact should be immediate and positive. As ductile a nickel as possible should be deposited, since hard nickel will result in cracking of the deposit down to the

lead alloy base. The cracks result from several basic factors. First, the stresses in nickel are large in comparison to the force of adhesion; second, the tensile strength of the lead alloy is only about one-fourth that of the nickel plate; lastly, the coefficient of expansion of lead is over twice that of nickel. The question arises as to what should be the composition of the nickel solution. We have shown that the use of sulphuric and hydrochloric acids as dips in the preparatory cycle had always been a source of potential trouble in plating lead and lead alloys. The substitution of fluoboric acid eliminated this phase of the platers problem. Consequently, since sulphuric and hydrochloric acids (or the sulphate and chloride ions) are detrimental to the successful preparation of lead alloys before plating, it is logical to conclude that they would be detrimental if present in the plating solution. This is particularly true in respect to our present day highly acid (low pH) bright nickel solutions, in which sulphuric or hydrochloric acids are used to keep the pH in the proper bright operating range.

Just as fluoboric acid answered the requirements for an acid dip that does not leave any residual surface films in the preparation for plating, then nickel fluoborate answers the requirements for a nickel deposit on lead, lead alloys, and articles of holloware with lead attachments. The nickel fluoborate solution has been used for several years on lead stereotypes to improve the wearing properties of these printing plates and, in this respect, has displaced the sulphate baths formerly used. Additionally, the fluoborate bath is used in the plating industry for the plating of novelty items made of antimonial lead, instead of copper plating prior to bright nickel plate, silver, copper and brass plating. To the writer's knowledge it has not been used in the holloware industry. A step in that direction would result in improved quality holloware. Furthermore, since fluoboric acid is such a good solvent for surface films, it is logical to conclude that the nickel fluoborate solution, with its excess acid, would perform in the same direction, to remove surface oxides that might be formed during the rinsing operations and air transference to the plating solution. There are many advantages of the nickel fluoborate solution, and those of prime interest in plating lead, lead alloys and holloware with lead attachments are:

1. It is a high conductivity nickel plating solution comparable to any solution in industrial use.
2. Even at low current densities the efficiency is over 90%.
3. Mechanical properties of the deposited nickel are good, particularly the ductility which is fully as high as that of nickel from a Watts bath, operated at optimum conditions for ductile deposits.
4. There is no tendency to form any films on copper, brass, or nickel-silver base metal, so that the adhesion of the nickel deposit is excellent.
5. The residual contractile stress in the deposits from the fluoborate solution is only about two-thirds of that in nickel deposited from a Watts solution under comparable conditions.
6. It has a high buffering capacity, thus minimizing rapid changes in pH.
7. The solution is easy to make up and control, has excellent stability, and low sludge formation.

8. It can be operated over a wide range of current densities, maintaining its fine-grain deposit, ductility and color. It has good throwing power.

A disadvantage of the nickel fluoborate solution in its corrosiveness, which prevents the use of the auxiliary equipment presently used in most plating departments. But equipment can be purchased suitable to resist the corrosive effects of the solution.

A good general purpose nickel fluoborate solution for use on lead, lead alloys, and holloware with antimonial lead attachments is:

Nickel fluoborate	40 ozs./gal.
Boric Acid	4 "
pH (colorimetric)	2.7-3.5
Temperature	110°-130°F.
Voltage	3.5-4.5

Copper plating can be done directly (after the fluoboric acid dip, thoroughly rinsing in water, and immersion in 4 oz./gal. cyanide solution) in a warm copper cyanide solution at 5 amperes per square foot or, if the area is to be plated is unknown or difficult to estimate, strike at 3 volts for 15 seconds, and then reduce the voltage to 1.50-2.00. The free cyanide should be kept not exceeding 1 oz./gal., nor any lower than 0.50 oz./gallon. The copper deposit should be at least 0.0003" thick for two reasons. The first is to minimize the complete absorption of the copper deposit by the lead alloy; the second should a nickel deposit (from a low pH bright nickel solution) be subsequently plated over the copper plate, that the nickel may not become blistered. Copper strikes or thin deposits (less than 0.0001"), because of their porosity, invariably lead to the blistering of subsequent nickel deposits.

Furthermore, a heavy copper deposit can be of additional advantage, in that copper has a coefficient of expansion between lead and nickel, and would help to buffer the strains inherent in a nickel deposit.

Answer to the Problem

Having now completely covered all the related difficulties in plating lead and lead alloys, we can now turn back to the problem that this article started with. As already mentioned, neither the alkali cleaning nor the acid dips were the cause of the blisters. At this point the reader probably has already determined the cause, namely the copper strike. Too little copper was deposited in 30-45 seconds, so that the porous copper deposit was penetrated by the highly acid bright nickel solution, attacking the lead with the formation of insoluble lead sulphate. Or the copper deposit being porous, it is possible that all the cyanide from the copper cyanide plating solution was not neutralized by the 5% sulphuric acid dip (the use of fluoboric acid at this point would have been preferable) before the bright nickel and, upon immersion in the bright nickel, basic salts were precipitated in the pores. Anyone who has plated articles with blind holes in them, can appreciate this point of view. However, basically the cause of the difficulty was too light copper or a porous copper deposit. When the copper strike, as an undercoat for bright nickel, was replaced with a copper plate of 5 minutes, no more blistering was encountered in any of the cases. To safeguard against later difficulties when some of the copper undercoat would be absorbed by

the lead base, the actual copper plating time was extended to eight minutes.

Nickel plated antimonial lead alloys must be chromium plated with great care. Electrocleaning previous to chromium plating is not recommended because the electrocleaning would have to be performed cathodically and, consequently, there is too much danger of the deposition of a foreign film, which would result in a cloudy chromium deposit. The plating should not exceed three minutes at 100 amps./sq. ft. and every means should be taken to prevent burning of the chromium deposit by proper racking, and current density control to give a uniform bright deposit. Burning necessitates hard buffing under which blistering may result with the most carefully prepared nickel coatings.

The tensile strength of lead alloys is relatively low, ranging from 2000-5000 lbs./sq. in. Therefore, the strength of adhesion of any electroplate on lead cannot be any greater than this value. In color-buffing silver plated lead alloys, difficulty is seldom experienced because, in the first place, silver plate is soft and yields readily to buff pressure in coming to a luster and, second, silver plate under the current conditions that it is plated is seldom burnt. However, if buffing is necessary after chromium plating, it should not be done with high pressure, and hard high speed wheels. The heat generated can cause plastic flow of the lead alloy under the plate, and blistering usually is the result.

General Practices for Holloware and Novelties

The body parts of holloware and novelty items generally are made of copper, brass, and nickel silver. The component parts are made on power presses, spinning lathes, drop hammers, and small parts on screw machines. In between the draw, forms, etc., operations one or more annealing operations are usually performed, and necessary pickling operations to remove scale. After the component parts are completely shaped, most generally they are given a bright dip.

Dependent upon the quality of goods being manufactured, their shape or size, and the condition of the basis metal, the next operation is sand bobbing to smooth the surface metal for grease buffing. After sand buffing, the parts are washed and then grease buffed. The nature of the part permitting or depending upon how well the manufacturer is equipped, the buffing is done on automatic machines. Otherwise the parts are hand buffed.

After degreasing, the component parts go to the solderer to join the parts together. The parts may or may not be hard soldered. Most generally they are joined with soft solder. After soldering they are immediately washed to remove soldering acid and fluxes, in order to prevent pitting, and are dried. The next step is to solder on the lead attachments. Intermediate spot buffings are performed. Seldom are all the necessary soldering or attachments put on in one handling, because of the various degrees of skill required to perform some of the soldering operations, and the intermediate spot buffings required. The soldering operations generally follow this sequence: Solder body parts. Attach handles and spouts. Attach borders or body designs. Attach legs. The various lead attachments, such as handles, spouts, etc., also receive separately to a

greater or lesser degree preliminary sand bobbing and buffing. Borders and design trim are shaped or formed so as to fit the various items they are to be attached to. After all the soldering has been completed, the items are given a spot buffing and a color buff and, after being degreased, are ready for the plating room processing.

Plating Procedures

The following procedures are of broad application, and should be applied as required, or according to the equipment the manufacturer has available.

Parts have been completely prepared for plating by having received the necessary buffing and coloring operations.

1. Soak in emulsion cleaner—160°F., 3-4 min.*
2. Hot water spray rinse.
3. Soak trichlorethylene degreaser, 3-4 min.
4. Spray degrease.

The above operations are usually performed in a department separate from the plating department.

FLOW CHART #1 — SILVER PLATE

1. Soak clean in an alkaline cleaner.
2. Rinse.
3. Cyanide dip for work stained or tarnished.
4. Rinse.
5. Electroclean—cathodic.
6. Rinse.
7. Brush and scour. Insides of hollow articles are wet brushed or scoured with pumice.
8. Sponge complete surfaces.
9. Rinse.
10. Electroclean—cathodic.
11. Rinse.
12. Fluoboric Acid, 10%; 5-15 seconds.
13. Rinse.
14. Nickel plate. A light nickel plate (5 min.) is used to get a good silver strike and plate on the attachments. Without nickel the tendency is to acquire a too white, rough silver deposit. Standard white nickel is used; 110°F., pH 5.4-5.8.
15. Rinse.
16. Cyanide dip.
17. Silver strike—use inside anode as required.
18. Silver plate.

FLOW CHART #2 — SILVER PLATE

1. Electroclean 170-180°F., cathodic, 6 volts, C.D. not over 20 amp./sq. ft. Higher current densities create excessive alkalinity at the cathode which will cause an increased attack on the lead alloy. Cleaning time should be short, usually 10 sec.-1 min. A cleaner should be chosen particularly for cleaning lead alloys, and whose surface active materials do not form insoluble lead salts.
2. Rinse—preferably warm water.
3. Scratch brush insides, soldered joints and lead attachments with soap bark water.
4. Rinse and sponge surfaces complete.

*Packed in tripoli and othed buffing compounds may be blown out with steam, and then proceed with steps 3 and 4.

5. Electroclean same as in (1) 15-20 sec.
6. Rinse.
7. Rinse.
8. Fluoboric acid, 10%; 5-15 sec.
9. Rinse thoroughly.
10. Copper cyanide plate 120° F., 5 min.
11. Rinse.
12. Fluoboric acid 10%-5 secs.
13. Nickel plate—110°F., 5 min.
Or plate 10 min. and eliminate steps 10, 11 and 12.
14. Rinse.
15. Cyanide dip.
16. Silver strike.
17. Silver plate.

FLOW CHART #3 — SILVER PLATE

1. Soak alkali cleaner—140°F., 2 min; changed every other day. Copper body must not be discolored with lead.
2. Rinse.
3. Scratch brush lead attachments, insides, and bottoms with freely running soap bark water and pumice slurry.
4. Electroclean—180°F. cathodic, 6 volts, 15 secs.
5. Rinse.
6. Mop entire surface with a soft sponge.
7. Storage in clean water tank.
8. Electroclean, 180°F., cathodic, 6 volts, 15 sec.
9. Rinse.
10. Fluoboric acid dip, 10%; 5-15 sec.
11. Rinse.
12. Cyanide dip.
13. Copper strike to cover solder and lead attachments.
14. Copper plate 5-8 mins.
15. Rinse.
16. Fluoboric acid dip, 10%; 5 sec.
17. Rinse.
18. Nickel plate—5 min.
19. Rinse.
20. Cyanide dip.
21. Silver strike.
22. Silver plate.

FLOW CHART #4 — SILVER PLATE

1. Alkali electroclean—direct current 3-4 volts, 140°F., 1 min. Copper etc. bodies must not be discolored by lead. Solution should be changed 2 or 3 times per week.
2. Rinse.
3. Scour insides and bottoms with pumice if required. Scratch brush soldered joints and lead attachments with soap bark water.
4. Sponge entire surface.
5. Store in clear water.
6. Alkali electroclean—direct current 3-4 volts, 170-180°F., 15-20 sec. Changed every week.
7. Rinse, preferably 130-140°F.
8. Rinse, cold water.
9. Fluoboric acid dip 5-10%; 10-15 secs., room temperature.
10. Rinse.

11. Nickel plate—fluoborate solution 3.5-4.0 volts; 100-110°F., 5-8 min.
12. Rinse.
13. Cyanide dip— $\frac{1}{2}$ lb./gal. potassium cyanide.
14. Silver strike—potassium cyanide type.
15. Silver plate—potassium cyanide type.

FLOW CHART #5 — CHROMIUM PLATE

1. Electroclean 4 ozs./gal., 160°F., 2 min.
2. Rinse.
3. Scratch brush insides, bottoms, with soap bark water and pumice slurry.
4. Scratch brush soldered joints and lead attachments with soap bark water.
5. Rinse.
6. Sponge with cleaner 4 oz./gal. 160°F.
7. Rinse.
8. Fluoboric acid dip—10%; 5-15 sec.
9. Rinse.
10. Cyanide dip.
11. Copper cyanide strike.
12. Bright copper plate—2 $\frac{1}{2}$ volts, 140°F., 5 min.
13. Rinse.
14. Fluoboric acid dip—10%; 5 sec.
15. Rinse.
16. Bright nickel plate, 3 volts, 140°F., 8 min.
17. Rinse.
18. Re-rack for chromium.
19. Dip conc. hydrochloric acid for nickel activation.
20. Rinse.
21. Dip 10% sulphuric acid to remove traces of chlorides.
22. Rinse.
23. Chromium plate 4-5 volts, 100-125 amps./sq. ft., 110°F., 3-5 min.

FLOW CHART #6 — CHROMIUM PLATE

1. Alkali electroclean—direct current 3-4 volts, 140°F., 1 min. Copper, etc., bodies must not be discolored by lead. Solution should be changed two or three times per week.
2. Rinse.
3. Scour insides and bottoms with pumice if required. Scratch brush soldered joints and lead attachments with soap bark water.
4. Sponge entire surface.
5. Store in clear water.
6. Alkali electroclean—direct current 3-4 volts, 170-180°F., 15-20 sec.
7. Rinse, preferably 130-140°F.
8. Rinse, cold water.
9. Fluoboric acid dip, 5-10%; 10-15 sec.
10. Rinse.
11. Nickel plate—fluoborate solution 4.0-5.0 volts; 100-111°F., 5 min.
12. Rinse.
13. Bright nickel plate.
14. Rinse and re-rack
15. Activate in concentrated hydrochloric acid.
16. Rinse.
17. Dip—10% sulfuric acid.
18. Rinse.
19. Chromium plate.

Surface Treatment and Finishing of Light Metals

Part II. Corrosion and Protection of Aluminum

By S. Wernick, Ph.D., M.Sc., F.R.I.C., F.I.M., and R. Pinner, B.Sc.

NO discussion of surface treatments would be complete without considering the changes in appearance and properties that the metal article undergoes in service, and which determine its useful life.

Causes of deterioration may be due either to mechanical action, such as deformation, fracture, abrasion etc., or may be due to corrosion, i.e., chemical or electrochemical reaction of the metal with its environment; frequently the two types of attack interact, as in the phenomenon of stress corrosion, corrosion fatigue, fretting corrosion, or erosion, in which joint mechanical and corrosive attack may affect the metal to a greater extent than the sum of the same factors acting separately.

The protective characteristics of the light metals appear at first sight to show anomalous features, but these can be readily reconciled when it is remembered that the metals are highly electronegative and possess strong affinity for oxygen. These factors have a considerable influence on their chemical properties. Normally, the light metals would be expected to display little chemical stability and a strong susceptibility to corrosive influences. Yet the corrosion resistance or even commercial grades of aluminum is much superior to that of steel and in many aspects exceeds that of copper. Pure magnesium is only little inferior. As an instance, Devereux and Telfer¹ exposed some aluminum alloys and mild steels to salt spray (3 per cent NaCl plus 1 per cent HCl) for 70 hours with the following results:—

Average loss in weight for aluminum alloys	0.675 mg./sq.cm.
Average loss in weight for mild steel	11.07 "

The increased stability imparted to the light metals arises from an oxide film which forms rapidly on the exposed surface and inhibits further corrosion. The properties of this film and its protective influence will be dealt with when some of the factors affecting the corrosion of aluminum and its alloys have been discussed.

Corrosion of Aluminum

There is an extensive literature on the electrochemical mechanism of corrosion; for the present purpose, it will suffice to outline briefly the various causes of corrosion and their importance to aluminum and its alloys.

Three main factors determine the onset and the extent of the corrosive attack on the metal:

- (1) The corrosive environment.
- (2) Corrosion currents.
- (3) Mechanical action or erosion.

The corrosive attack on aluminum and its alloys may be due to any or several of these causes, and may result either in more or less severe pitting and dissolution of the surface, or in intergranular corrosion leading to deterioration of mechanical properties which in turn can result in the failure of the metal under conditions of stress.

THE CORROSIVE ENVIRONMENT:

The three main environments which have to be considered are exposure to the atmosphere, exposure to water, (including sea water) and finally the influence of various other media with which the metal comes in contact, e.g., in the chemical industry.

The resistance of individual alloys, or of various different protective coatings often differs considerably with the type of environment. Thus, alloys highly resistant to marine exposure will often be inferior in the sulphurous fumes of industrial atmosphere.

Various chemicals attack aluminum and its alloys to a greater or less degree according to the conditions of concentration, temperature, etc., prevailing. The amphoteric nature of aluminum makes it susceptible to chemical solutions of high and low pH. Some of the more important chemical reactions will be referred to in dealing with specific corrosion problems and the protective methods necessary to counter them. A fairly comprehensive description of the effect of individual chemicals, frequently given in considerable detail, is contained in the works of C. H. Jacobsen² and M. Schenk.³

CORROSION CURRENTS:

Corrosion currents are set up when the metal forms part of a galvanic cell, e.g., in contact with a more electropositive metal or alloy. Thus, the rate of attack in aqueous solutions is strongly influenced not only by other metals in direct contact but also by the alloy composition, metallic impurities and by the structure of the alloy.

When metals of different potential (see Table III) are in contact, the corrosion velocity is affected by the

Table III

Potential Difference between Aluminum and Various Metals

Metal	Mg	Be	Al	Si	Mn	Zn	Cr	Fe	Co	Ni	Sn	Sb	Cu	Hg
Potential Diff. (volts)	-0.28	-0.15	0.0	+0.02	+0.02	+0.52	+0.62	+0.84	+0.97	+1.05	+1.17	+1.52	+1.61	+2.13

formation of local cells with resultant dissolution of the anode. In the simplest case, therefore, the corrosion resistance of a metal is increased by contact with more electronegative metals and diminished by that of more noble metals.

This has an important bearing not only on the degree of resistance to corrosion of individual alloys, but also to protective measures, e.g., aluminum alloys which are more noble than the pure metal may be protected by spraying of pure aluminum, the latter forming the anode in the corrosion cell. On the other hand, the addition of even relatively small quantities of the more noble heavy metals, such as copper, iron, nickel, etc., set up local currents when in contact with aluminum, and such alloys have a relatively poor corrosion resistance. Moreover, if the alloy constituents of a homogeneous alloy (and this includes most aluminum alloys) are attacked by the same corrosive medium, the corrosion velocity will be most rapid when the distribution is non-uniform. In this connection, it must be borne in mind that inter-metallic compounds as well as various constituents of solid solutions and indeed any conducting impurity, may set up local currents with the major constituent and increase the velocity of any corrosive attack on the metal.

Wrought and Cast Alloys and Heat Treatments

The corrosion resistance of alloys in the cast state depends upon the method of casting, the pouring temperatures and subsequent heat treatments, which may either increase the corrosion resistance by increasing the chemical homogeneity of the alloy, or decrease it by throwing compounds out of the solid solution into the dispersed state resulting in the formation of local elements. In this way, solution heat treatments followed by rapid quenching usually improve corrosion resistance in the copper-containing alloys, while artificial hardening generally decreases it.

In the wrought alloys, the conditions are similar, while the cold working and annealing undergone by these alloys always increases homogeneity and has a beneficial effect on the corrosion resistance.

The heat treatment of alloys is of great importance on the development of modern high-strength alloys, and it will be of interest to consider it briefly.

An aluminum alloy may be strengthened and hardened by heat treatment only if the solid solubility of one of its constituents is decreased with diminishing temperatures. This condition is fulfilled in the copper-containing alloys, as well as, for instance, the aluminum-magnesium-silicon alloys, in which the magnesium silicide (Mg_2Si) has a solid solubility of 1.85% at 595°C. and 0.2% at room temperature.⁴

Normally, heat treatment takes place in three stages. First the alloy is heated to 500 to 540°C. for about six hours in order to put one or more constituents into solid solution. The alloy is then quenched rapidly

in water at about 90°C., which holds the dissolved constituent in supersaturated solution. Finally, the alloy is hardened either by resting at room temperature for five to six days (age hardening) or at slightly elevated temperatures, e.g., in boiling water or oil for one to two hours (precipitation treatment). This promotes submicroscopic precipitation of constituents in the form of a critical dispersion, increasing both the strength and the hardness of the alloy.

Effect of Alloy Constituents and Impurities

Compounds present in aluminum and its alloys may be either non-metallic impurities, components forming intermetallic compounds or secondary constituents, or components going into solid solution intergranularly.

In the first case, it is unlikely that electrochemical action may occur except indirectly, e.g., by differential aeration cells set up in cavities between inclusions and aluminum. If they are large, inclusions may also be detrimental to the corrosion resistance by forming channels for the passage of liquids, or may assist breakdown of the film on the metal surface. Metallic impurities present either as elements or as inter-metallic compounds, on the other hand, aid corrosion by setting up local currents until stabilized by polarization or over-voltage, or may raise the anodic potential locally to the film breakdown value.

The effect will depend on the potential, if this is different from that of the bulk, the surface will be pitted. If the difference in potential exists between the grain and the grain boundaries, intergranular corrosion may result which may cause a tendency to failure under stress. Homogenizing heat-treatments will to some extent improve the corrosion resistance. Thus, silicon held in solid solution by heating to 500°C. and quenching will have much less effect on the corrosion resistance of the alloy than if the latter is allowed to cool slowly. An important, often unrecognized, part is also played by the surface finish. A smooth surface is often more resistant to corrosion than a rough one, partly because dirt and moisture, etc., is more easily held in the recesses but also because of the difference in concentration gradients between the recesses or scratches and the projections. Microscopic cavities may also be responsible for pitting. The precise effect of the surface finish will vary with the composition of the metal. Thus, Wolf and Neunzig¹³ produced samples of aluminum of 99.988% and 99.2% purity, which were tested by 8-12 months' exposure to running water (1) in the "as drawn" condition, (2) etched in sodium hydroxide. In these tests the high purity aluminum showed more pits on drawn samples which were centered around the draw marks, while the lower purity metal was less resistant after etching. In general, also, chemical or electropolishing gives surfaces more resistant to corrosion than mechanical polishing. This is sometimes due to the presence of oxide films after chemical or electrolytic treatment, or due to inclusions

of polishing abrasive or composition during wheel polishing, but also because of the potential difference between the metal and the highly stressed flowed surface layer caused by buffing.

The effect of individual constituents or impurities is discussed in detail below. Table IV shows the potential differences between some of the more important constituents.

Table IV

The Dissolution Potentials of various Alloys or Alloy Constituents (0.1 N calomel electrode) in a solution containing 53 g./l. sodium chloride and 3 g./l. hydrogen peroxide¹⁴

Constituent	Potential
Mg ₅ Al ₈	—1.07
Al-Zn-Mg (4% MgZn ₂) solid soln. —	—1.07
MgZn ₂	—1.04
Al-4% Zn solid solution	—1.02
Al-1% Zn solid solution	—0.96
Al-4% Mg solid solution	—0.87
MnAl ₆	—0.75
Al 99.99%	—0.85
Al-Mg-Si (1% Mg ₂ Si) solid soln. —	—0.83
Al-1% Si solid solution	—0.81
Al-4% Si solid solution	—0.69
FeAl ₃	—0.56
CuAl ₂	—0.53

MANGANESE:

As seen from Table IV, there is little or no difference in potential between MnAl₆ and aluminum. On the other hand, small quantities of manganese often increase the corrosion resistance. This is thought to be due in part to the elimination of iron (which is detrimental) by formation of MnFeAl₆ which sinks to the bottom of the melt, while the presence of manganese may also suppress the formation¹⁵ of AlSi₂Fe. In the absence of iron, the addition of manganese has little effect.

LEAD:

At least in some conditions, the presence of small quantities of lead is detrimental, e.g., 0.008-0.65% reduced the resistance of the aluminum to sodium hydroxide,¹⁶ though 0.5% lead had little or no effect.¹⁷ Nor was 0.15-1.4% Pb found to deteriorate the corrosion resistance of pure aluminum in the atmosphere or in sea water.¹⁸

IRON:

Iron is a common impurity in aluminum and has a marked effect on its corrosion resistance. The solubility of iron is very small, 0.005% at 500°C., and excess iron forms the intermetallic compound FeAl₃. Again the effect of iron contact varies with the environment. Thus Schick and Helling¹⁹ found that 99.99% aluminum can take up to 0.07% iron without effect on the corrosion resistance in water or in salt solution. Similar results were obtained by R. Schnell²⁰ while W. Straumanis²¹ found no effect on adding 0.01% iron to aluminum immersed in 2 N. hydrochloric acid.

The effect of iron on the dissolution rate of high purity aluminum rises rapidly with its concentration, however, and at 0.1% Fe in 99.998% aluminum is 160 times that of the same amount of copper. Different results in the corrosive environment have been reported by other workers. In dilute sodium hydroxide the attack on aluminum is increased markedly in the presence of more than 0.014% iron²² while little effect is found in sulphuric or nitric acid at up to 0.1% iron.

SILICON:

The effect of silicon on the corrosion resistance is complex, and largely interdependent with the iron content. Silicon, which is a major constituent of many aluminum alloys, particularly for castings, is also one of the principal impurities in the metal.

Excess silicon is present as flakes similar in shape to graphite and is cathodic to aluminum. The solubility limit under equilibrium conditions is 0.05% at room temperature rising to 0.1-0.2% at 300°C. and 0.5-0.8% at 500°C. By quenching from 500°C. the solid solubility may be held at 0.5%, however. In the presence of iron, silicon may go into solid solution in the FeAl₂ intermetallic compound, which is cathodic to aluminum. On the other hand, Mg₂Si present after hardening the heat-treatable Al-Mg-Si alloys has little effect on the corrosion resistance. In the absence of iron up to 0.7% silicon had no effect on 99.99% aluminum¹⁹ in sodium hydroxide or de-ionized water, and there is some evidence that a small amount of silicon is required to form the protective film which protects the metal in boiling water.²³

In general, the effect of the silicon content appears to be less important than the combined iron and silicon content. This fact is recognized by alloy specifications of several countries. Thus, the American Society for Testing Materials gives a maximum value of 1% Fe+Si for commercial 99% aluminum.

COPPER:

As has been seen, copper is present in varying proportions in many of the high-strength aluminum alloys. It may also be present, however, as an impurity in commercial aluminum or other alloys. Even small amounts may have a serious effect on the corrosion resistance. In the presence of 0.1% copper the corrosion rate of super-purity aluminum is increased 1600 times, i.e., 10 times as much as the equivalent quantity of iron. In smaller proportions Schick and Helling¹⁹ found that 0.005% copper produced pitting in super-purity aluminum or exposure to de-ionized water while 0.02% had a detrimental effect on the corrosion resistance of high purity aluminum reflectors.²⁰ Other evidence shows that under some conditions copper dissolved from aluminum may be redeposited and increase the rate of attack.

The effect on the corrosion resistance of the addition of various amounts of copper, iron and silicon to 99.996% aluminum has been investigated also by Zeerleder and Zurbrugg after annealing and solution heat-treatment as well as in the hard rolled condition. The rate of dissolution in oxidized sodium chloride and concentrated nitric acid are shown in Table V.

Table V
Effect of Impurities on Corrosion Resistance
of 99.996% Aluminum

Rate of Dissolution in mg./sq.cm./day.						
Impurity	%	Hard rolled.	14 hours at 300°C. air-cooled.		1 hour at 800°C. quenched.	
		3% NaCl + 1% H ₂ O ₂	3% NaCl + 1% H ₂ O ₂	Conc. HNO ₃ (20-22°C.)	3% NaCl + 1% H ₂ O ₂	Conc. HNO ₃ (20-22°C.)
None		0.0015	0.0014	0.53	0.0014	0.53
Copper	0.050	0.0150	0.0155	0.95	0.015	0.94
	0.060	0.0150	0.0205	0.97	0.017	0.92
	0.20	0.0905	0.036	1.02	0.024	0.93
	0.43	0.116	0.044	1.10	0.027	0.98
	0.66	0.1125	0.048	1.15	0.038	0.93
Iron	0.004	0.0020	0.0016	0.54	0.0018	0.54
	0.014	0.0025	0.0018	0.51	0.0013	0.55
	0.10	0.0030	0.0019	0.58	0.0021	0.61
	0.31	0.0030	0.0027	0.60	0.0021	0.58
	0.66	0.0045	0.0035	0.61	0.0028	0.65
Silicon	0.051	0.0025	0.0013	0.57	0.0016	0.53
	0.11	0.0025	0.0024	0.58	0.0018	0.51
	0.19	0.0030	0.0025	0.62	0.0016	0.49
	0.50	0.0030	0.0011	0.66	0.0018	0.50
	0.89	0.0045	0.0039	0.70	0.0035	0.48

The data in Table V clearly show the serious effect of copper compared with iron and silicon, the influence of the last two being approximately similar. It is significant also that the samples which were in the hard-rolled condition dissolved faster than annealed and solution heat-treated and quenched specimens in that order. The effect of small quantities, i.e., up to approximately 0.5% of iron and silicon in heat-treated and quenched samples is seen to be very slight.

MAGNESIUM:

The effect of magnesium is complex and varies with the alloy structure and with the corrosive environment. In neutral or acid solution, magnesium appears to have little effect on the corrosive resistance. As mentioned earlier, there is some evidence that the presence of magnesium makes aluminum more resistant to sea-water corrosion. In alkaline solutions, however, magnesium may be harmful, e.g. according to Benson and Mears,²⁵ the presence of a small proportion of magnesium reduces the resistance of aluminum to sodium hydroxide.

MANGANESE:

Besides its beneficial effect in eliminating iron from cast alloys, manganese has little or no effect on the corrosion resistance. As seen from Table IV the potential of Al₆Mn is similar to that of pure aluminum. There is some evidence, however, that it may be harmful in 99.998% aluminum after annealing at 300°C. though not after quenching from 500°C.

Zinc

Zinc is added to several of the more recent types of high strength aluminum alloys. As an alloy constituent, zinc is slightly cathodic to aluminum though its effect on the corrosion resistance is less pronounced than that of copper or iron. Thus, the addition of up to 0.2% zinc has little effect on the attack of 99.996%

aluminum in acids or alkalies. At higher concentrations, 0.47-0.69%, it reduces the metal's resistance to hydrochloric acid and oxidized sodium chloride solution, though it has little effect in sulphuric acid, conc. nitric acid or dilute alkalies.²⁴

CADMIUM:

Cadmium is not very frequently found in aluminum in any quantity. In small proportions there is some evidence²⁶ that it reduces the corrosion of aluminum-copper alloys in dilute hydrochloric acid and sodium chloride.

NICKEL:

Although a frequent alloying constituent in heat-treatable (particularly casting) alloys the effect of nickel on the corrosion resistance has not been very thoroughly investigated. On the whole its effect appears to be slightly less serious than either copper or iron.²⁵

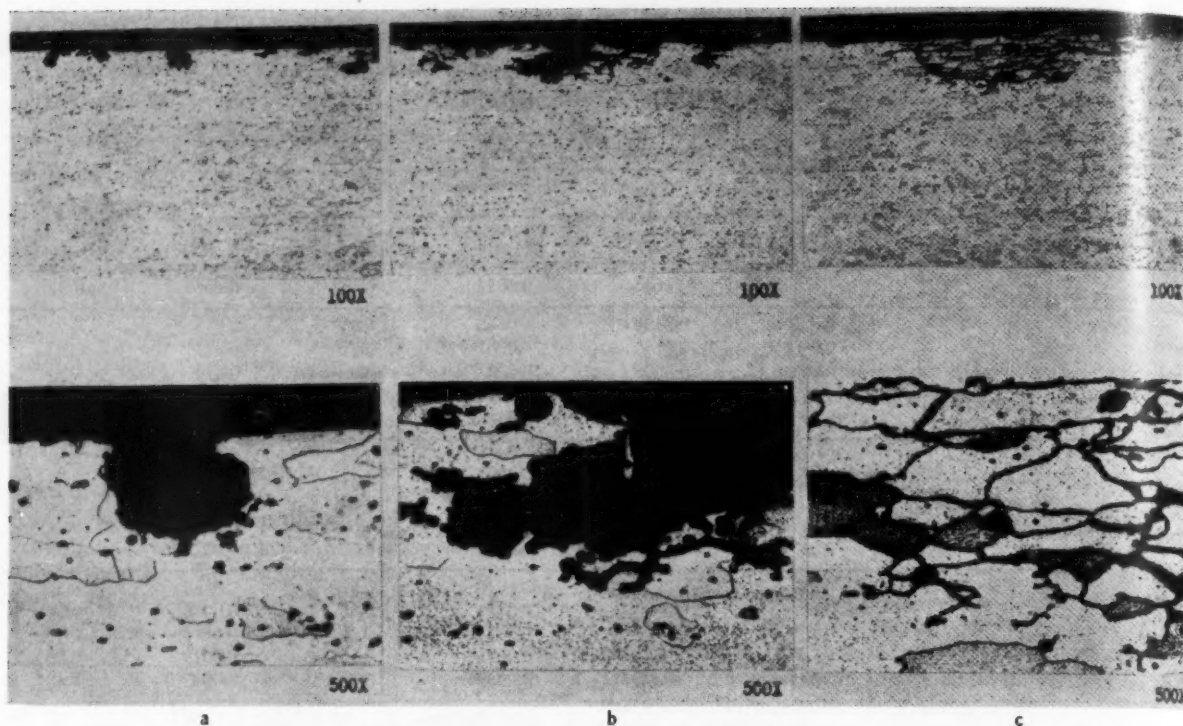
TITANIUM:

Small quantities (approx. 0.01%) of titanium are often present in aluminum alloys. Its effect on the corrosion resistance is small. Between 0.007-0.08% is reported to have an adverse effect on the resistance of S.P. aluminum to alkali,¹⁶ though in some acids, e.g., mixtures or hydrochloric acid-nitric acid-hydrogen peroxide the addition of 0.16-1.37% titanium to commercial aluminum has been stated to be beneficial.²⁸ Titanium appears to have little effect on the resistance of aluminum to salt solution.²⁹

OTHER CONSTITUENTS:

Calcium should not be present in proportions greater than 0.1% according to Grashchenko & Darovski,³⁰ though according to other authors 0.5-1.0% calcium has little effect on the resistance to alkali solutions.¹⁷

The effect of phosphorus which is sometimes added



Cross sections illustrating corrosion in aluminum-copper alloy sheet. Etched in $\text{HCl}/\text{HNO}_3/\text{HF}$. (a) Pitting attack. (b) Pitting with slight intergranular attack. (c) Intergranular attack. (American Society for Metals, "Corrosion of Metals," article by E. H. Dix, pg. 142.)

in small quantities to wrought alloys, is detrimental and should not exceed 0.002%.³¹ Little work has been done on other metals though there is evidence that e.g., cerium and silver are detrimental. Little or no effect is shown by the presence of small quantities of chromium, tin, bismuth and boron. Alkali metals which are anodic to aluminum must be excluded as they have a tendency to aid the onset of intergranular corrosion. This has been shown, for example, with 0.04% sodium.³⁰

Intergranular and Stress Corrosion

Intergranular corrosion (which is illustrated in Fig. 1) is caused by local currents set up between the grains and grain-boundaries and results in loss of strength which may consequently fail under stress, after a time, which may vary between a few days and several years. This form of corrosion may generally be detected by cleaning the metal thoroughly, when surface localities are often removable with a knife. Protective treatments, such as anodizing or chemical treatments, have only a limited effect on this type of corrosion and only if applied after any deformation by working is over. Resistance to intergranular corrosion is greatly lowered by incorrect heat treatment or slow quenching, and heat-treatment ovens⁵ have recently been constructed for the exact control of the process and rapid automatic transfer to the quenching tanks. Intergranular corrosion is most important in the copper-containing alloys such as duralumin, and when fully annealed, copper, due to precipitation of CuAl around the grain boundaries, causes a measurable potential difference in these areas.

Stress corrosion, on the other hand, is caused by a difference in potential between two areas within the metal and occurs, according to E. H. Dix⁶ when (a) the alloy is susceptible to selective corrosion along

more or less continuous paths, e.g., the grain boundaries, in cases where the internal structure is microscopically heterogeneous, and (b) when there is a condition of high stress, tending to pull the metal apart along these continuous paths. When these conditions exist simultaneously and the metal is subjected to the requisite corrosive environment, corrosion starts along the continuous paths, and accelerates, both with the resulting increases of stress at the bottom of the notches formed and with the destruction of any protective film by cracking, and the exposure of a fresh anodic surface.

Different alloys show varying susceptibility to intergranular and stress corrosion depending on the effect of different alloying constituents and conditions of heat treatments. A few examples may be quoted.

The higher the temperature from which the material is quenched, the smaller is the tendency to intergranular corrosion, though the tendency to pitting may be increased. Material quenched at 100°C. is more susceptible than that quenched in cold water, though ice-cooled water offers no advantage. It has been stated that the time interval between removal from the furnace and quenching should not be more than 10 seconds. On the other hand, rapid quenching may introduce stresses, often greatest at room temperature, and it appears thus that the conditions leading to maximum resistance to intergranular corrosion may actually favor the alloy's susceptibility to stress corrosion. If the material is quenched in oil, on the other hand, the temperature is of less importance and little stress is normally produced.

The temperature of hardening is also important, and duralumin type alloys, for example, lose strength and elongation rapidly in salt spray after precipitation treatment at 145°C.⁷ A pockform of intergranular corrosion also attacks the super-duralumins (containing

about 0.8% silicon) which are highly susceptible when hardened at around 140°C., though at temperatures below 125°C. and above 145°C. the alloy does not show pocks and suffers much less weakening. One aluminum-copper alloy, on the other hand, is most susceptible when hardened at 130°C. and the conditions vary from alloy to alloy. The adverse effect of temperature falls off in the higher ranges, as the precipitated particles along the grain boundaries coalesce into large grains, or diffusion of copper takes place from the interior of the grains.

Bad effects are experienced also when reheating alloys, as when enamelled work is baked or in the case of the double heat treatments employed on some modern alloys, the temperatures should be kept as low as possible and must be controlled carefully.

In the absence of copper, the aluminum-magnesium alloys suffer from intergranular corrosion when a network of B-phase (Al_2Mg_3) is produced by quenching and annealing, and it is better to air cool before annealing in contrast to the treatment of copper containing alloys.

The tendency to stress corrosion is reduced if the separation of intermetallic Al_3Mg_2 occurs in the coagulated form,⁵⁰ by heat-treating strongly deformed material so that recrystallization is only allowed to start.

In neutral chloride solution with the 7% Mg alloy, stress has no influence on the first stages of corrosion,⁴⁹ though the latter plays a vital role in the final cracking. At first scattered parts appear which increase in depth. In some alloys, attack sets in which is confined to the tops of cracks and causes mechanical weakening. Various additions have been tested to improve stress corrosion, and recent investigations have tended to show that "stabilizers" such as 0.3% chromium improve resistance to stress corrosion of aluminum-manganese-zinc-magnesium alloys,⁸ while in the aluminum-magnesium-zinc alloys, susceptibility is increased with increasing alloy content.⁹ A method suggested to reduce susceptibility in the aluminum-magnesium alloys is to reduce the magnesium content in the outer layers by heating the alloy in a fused nitrate bath, which also hardens the surface. The results of these and other investigations have generally shown, however, that where resistance to stress corrosion was increased, mechanical strength was often diminished, thus the ideal of high corrosion resistance allied to good mechanical properties is not easily attainable.

Dissimilar Metal Inserts

Another problem arising from the acceleration of corrosion due to dissimilar metal contact is occasioned by metal inserts in aluminum structures. The magnitude of this problem may be realized in the fact that, while in the absence of dangerous materials aluminum alloys may often be left bare even to outdoor exposure, steel-riveted duralumin structures may require as much maintenance painting as all-steel structures.

The acceleration of the corrosive attack may, in such cases, however, be due to a number of causes rather than to direct cathodic action of the steel. In the case of steel-riveted duralumin, for example, U. R. Evans¹⁰ suggests that the steel which under ordinary condi-

tions is actually anodic to the duralumin, is attacked first and that subsequent corrosion of the aluminum alloys is due to contact with corrosion products of the steel which act as an oxygen screen or set up iron/aluminum microcells. The increase in volume caused by the production of the hydroxides of iron and aluminum at the metal boundaries acts in this case as an accelerating factor in the disintegration of the steel rivet. Rivets should therefore, wherever possible, be of the same metal as the main components, and even related metals, e.g., aluminum sheet with duralumin rivets, need special protection by painting between the contacting surfaces.

Heavy metal inserts may also cause trouble in anodizing. While the aluminum is robbed of anodizing current, the current concentrates on the inserts and pits or corrodes them away. Rubber gaskets of suitable shape may be used or chemical oxidation or phosphate treatments substituted; these are only little affected by other metal contacts, the only effect in the former being a slight decrease in film thickness around the insert, provided the ratio of aluminum to insert surface is not too small, while phosphate coatings are unaffected by ferrous metal or zinc inserts. In this connection it may also be mentioned that aluminum is attacked also by moist plaster or cement, while painting with bitumen is necessary before embedding the metal in concrete or other building materials.

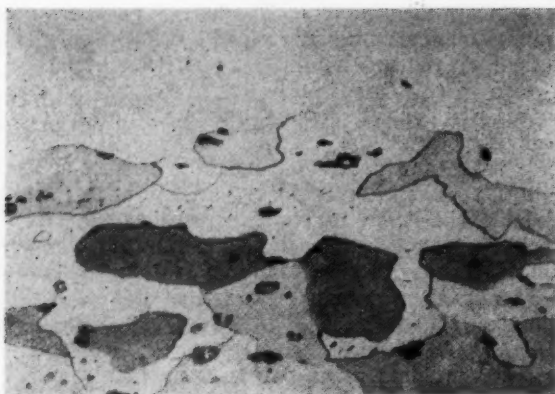
Super-Purity Aluminum

As we have seen, corrosion is considerably accelerated by the presence of impurities in the metal. In recent times with the commercial production of aluminum, first of 99.95%, then 99.99% purity, it was discovered that this metal had very different properties from commercial grades of aluminum (cf: Bibliography). A. Jenny and W. Lewis¹¹ quote M. Centnerscwer who found that 99% aluminum had a solution velocity 50 times as great as that of 99.95% aluminum in dilute hydrochloric acid, while considerably stronger acid was needed to start attack at all. From the same source it appears that R. Gateau found that 99.99% aluminum lost only 0.06 g./sq. dm. after 16 hours' immersion in concentrated hydrochloric acid; while Table VI gives comparative results obtained for various grades of aluminum in normal hydrochloric acid.

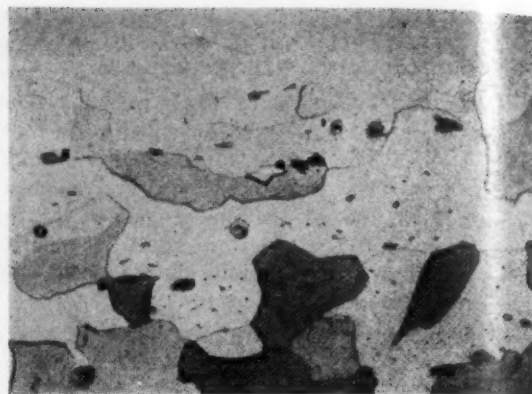
The cost of super-purity aluminum makes it impracticable, however, for any but a few applications, and accordingly, it is used for specialized purposes only, e.g., as a reflector material.

Table VI
Aluminum in N.HCl at 20°C.¹¹

Percentage aluminum	Loss in weight (g. in 20 hrs.)	cm ³ H ₂ evolved	Induction period cm ³ H ₂ in 4 hrs.
99.998	—	—	—
99.795	0.0008	0.99	—
99.711	0.0018	2.24	—
99.436	0.0516	64.1	32.7
94.5	0.0685	85.0	20.2



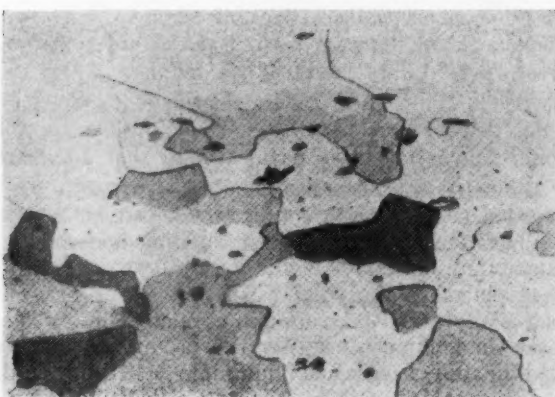
a



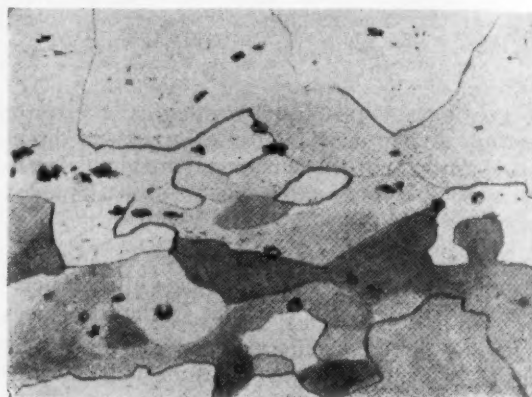
b

Diffusion of core of Alclad sheet into high purity coating for various periods of heat treatment. Noral 23ST Alclad, solution heat treated at 495°C. for (a) 15 mins. (b) 30 mins. (c) 60 mins. and (d) 120 mins. (X 500)

x = original coating, y = original zone of diffusion and z = original core.



c



d

Cladding of Aluminum Alloys

As already mentioned, one method of improving the corrosion resistance of wrought aluminum alloys is by the application of a plate of pure aluminum or aluminum alloy. This was first applied to the duralumin-type alloys but the treatment has been extended to many other alloys, ranging from those with an already high corrosion resistance, such as the aluminum-manganese alloy, to the new high-strength alloys. The cladding exerts its protective influence in two ways: (1) by mechanical protection, and (2) by electrochemical protection, in that the cladding is anodic to the heavy metal containing alloy, causing it to be attacked preferentially. While the mechanical properties of the clad alloys are usually but little different from the unprotected form, corrosive attack rarely penetrates further than the depth of the cladding. In the heat treatment of clad alloys, the alloying constituents diffuse into the coating, forming a "diffusion zone." There are thus three zones, only the first of which is usually attacked.

Care must be taken, however, not to prolong the heat treatment of clad copper-containing alloys due to the gradual broadening of the diffusion zone which will in time extend throughout the cladding. If this is allowed to happen, the protective value of the cladding will be lost.

Modern British D.T.D. specifications give the minimum composition of the aluminum cladding as 99.7%

aluminum, while American Alclad normally specifies a 99.5% purity. Cladding for the zinc-containing high-strength alloys often specifies a composition of 0.75 to 1.25% zinc, the remainder being aluminum. While more recently aluminum-manganese alloy cladding has been found useful.

W. Bunghardt,¹² describing corrosion tests on duralumin clad with pure aluminum, aluminum-manganese and aluminum-magnesium-silicon-manganese alloy claddings, found that while both the alloy coatings were about equal in value, the pure aluminum allowed copper to diffuse more rapidly through the coating. The best corrosion resistance was achieved by solution heat treatment at 500°C. for 30 minutes, and cold aging for three hours. Concerning other alloy claddings, M. Kalpers²³ described the mechanical properties and corrosion resistance of a copper-free dural cladding on duralumin, which gave excellent results as long as it was not frequently or lengthily annealed. A 5% thickness of pure aluminum and aluminum alloy on aluminum-magnesium-copper alloy possessed better corrosion resistance though poorer mechanical properties.

A type of coating allied to the claddings is an electrolytic copper coating on aluminum sheet, tubing and wire, and normally from 10 to 30% of the thickness of the alloy.

(Conclusion of Part II and References will appear in May issue.)

Metallizing with an Aqueous Platinic Chloride Solution

By Louis Silverman and Katherine Trego, Atomic Energy Research Department, North American Aviation, Inc., Downey, California

METALLIZING of non-conductors is now a common practice, and the processes have been described in detail.^{1,2,3} The reagent is usually an aqueous silver solution, and the intent may be to protect a softer material (plastic) from abrasion, to beautify a low cost material with a thin metallic coat or to prepare a conducting coating.

Not frequently considered is a coating on a porous porcelain form to make the form impervious to penetration by liquids or gases at high temperatures (1100°C.), yet to be of such nature that the coating material will not evaporate in moderate vacuum.

Platinum, in the form of a salt dissolved in oil (rosemary, lavender),^{1,4} has been applied to porcelain, and the metallic platinum coating is obtained by applying heat. Such coatings are usually contaminated with bismuth, lead or other metals which are purposely added to help bind the platinum to the surface. These impurities may make the platinum coating subject to attack by liquids or gases, and the impurities may volatilize into the atmosphere, and destroy the tests.

In this paper, it is shown that an aqueous solution of platinic chloride, containing a selected reducing agent, may be applied to many shapes of aluminum oxide, porcelain, ceramics, silicaware, quartz and etched Pyrex and that an adherent, electrical conducting coating of pure platinum is obtained. The thickness of this coating may be increased by the electrodeposition of platinum upon the thin thermal coating of platinum. The heavy coating may eventually be vacuum-baked to a bright metallic finish.

Solutions

Place 2 grams of platinum metal scrap in a 100-ml. beaker and add 35 ml. of hydrochloric acid and 5 ml. of nitric acid. Warm until the metal has completely dissolved, then evaporate to 20 ml. Cool. Take 5 ml. (20% chloroplatinic acid) and add 0.5 gram of hydroxylamine hydrochloride. The solution is now usable in this form. Such solutions have been found usable after storing for six months.

Hydroxylamine sulfate, hydrazine salts, formic acid, formaldehyde, etc., are usable as reducing agents but hydroxylamine hydrochloride is preferable.

The Metallizing Process

The form that is to be metallized may be dipped directly into the platinum solution, drained, then set in a holder; or the platinizing solution may be painted on with a brush. The blue flame of a bunsen burner is then played over the surface until the platinum coating appears. At no time should the surface be heated until red, in air, for the thin coating will oxidize and become useless. Heavier coats of metal may be obtained by painting on and drying two or more coats.

The resulting coat should be of a dull platinum color, spread uniformly over the base. It should be of high electrical conductivity. The thickness of coating may be increased by electroplating platinum on this base

coat. For this work, the diammino-nitrite platinum solution^{2,5} was used, and the plating performed according to instructions. In case a brighter coating is desired, the coating may be electropolished in a bath of 1:1 phosphoric acid,⁶ in which the platinum coating is the anode.

Whenever possible, a vacuum baking of the coating at 1100°C. is recommended. This results in a better protective and better looking product.

Discussion

The advantage of using an aqueous metallizing solution of this type is that the solution may readily be made up in the laboratory from scrap platinum metal, aqua regia and hydroxylamine hydrochloride. This solution will give a coating free of metal contaminants which are usually present in the oil-type platinizing liquids.

The oil solution, however, is superior to the aqueous solution when glass is the object to be metallized. The oil solution may be painted on Pyrex glass but, for the aqueous solution, the glass must first be roughened mechanically (sand blasted) or chemically (dipping in hydrofluoric acid). The aqueous solution may, in general, be used to coat dry materials which are not attacked by hydrochloric acid and are not affected at the 500°C. temperature range. These may include clays, oxides (aluminum oxide) and briquetted minerals, unglazed porcelains, ceramics and china, certain plastics containing asbestos fillers, quartz, roughened glass, silica and Vycor, etc.

A platinum coating is superior to a silver coating on the same points that platinum metal is superior to silver metal: resistance to the simple acids, hydrochloric, nitric, sulfuric, phosphoric, and hydrofluoric acids and resistance to tarnish.

A special use has been found for platinized coatings. Mullite tubes, or similar tubes that are used to shield thermocouple wire, are permeable to carbonaceous gases which attack the thermocouple wire. If the shielding tube is first metallized with the aqueous platinum solution, then a coating of rhenium metal may be plated⁷ on the platinum. The tube then has a thin gray coating of rhenium metal which prevents carbonaceous gases from attacking the platinum or penetrating through the shielding tube to the thermocouple.

Literature Cited

1. Heritage, R. J., and Balmer, J. R., *Metal Finishing*, **51**, 75 (Aug. 1953).
2. "Metal Finishing Guidebook" (1953).
3. Wein, S., "Metallizing Non-Conductors," Metal Industry Publishing Co., New York, N. Y.
4. Hanovia Chemical and Manufacturing Co., East Newark, New Jersey.
5. Baker and Co., U.S.P. 1,779,436 and 1,779,457.
6. "Metal Finishing Guidebook," page 234, (1953).
7. Fink, C. G., and Deren, P., *Trans. Am. Electrochem. Soc.* **66**, 471 (1934).
8. Levi, R., and Espersen, G. A., *Physical Review*, **78**, 231 (1950).

Bronze and Speculum Plates Provide Good Protection for Steel

By W. H. Safranek, W. G. Hespenheide and C. L. Faust*

Abstract

SALT-SPRAY and outdoor-exposure tests demonstrated that bronze alloy plate protects steel better than copper and/or nickel plates. Bronze plate with a decorative chromium overlay did not discolor as did copper plus chromium plate, in the outdoor weathering test. Bronze and speculum plate can fill the gap imposed by the shortage of nickel. Moreover, in free competition with nickel, bronze and speculum can meet commercial requirements in many applications. A revival of bronze and speculum plating is expected now that restrictions on tin in electroplating have been removed. Procedures for plating bronze and speculum alloy are compared, and the properties of the copper-tin alloy deposits are reviewed.

Introduction

Copper-tin alloys were electrodeposited at least thirty years ago.¹ Some of the properties of speculum-alloy plates have been reported,^{2,3} but very little data have

been published on the corrosion protection furnished by speculum or bronze plates. As a part of a six-year study of copper-tin alloy plating at Battelle Memorial Institute under the sponsorship of the City Auto Stamping Co., the corrosion performance of bronze and speculum plates was investigated by testing in salt-spray fog and exposing outdoors. This paper presents the results of the corrosion tests and discusses the processes for depositing the copper-tin alloys.

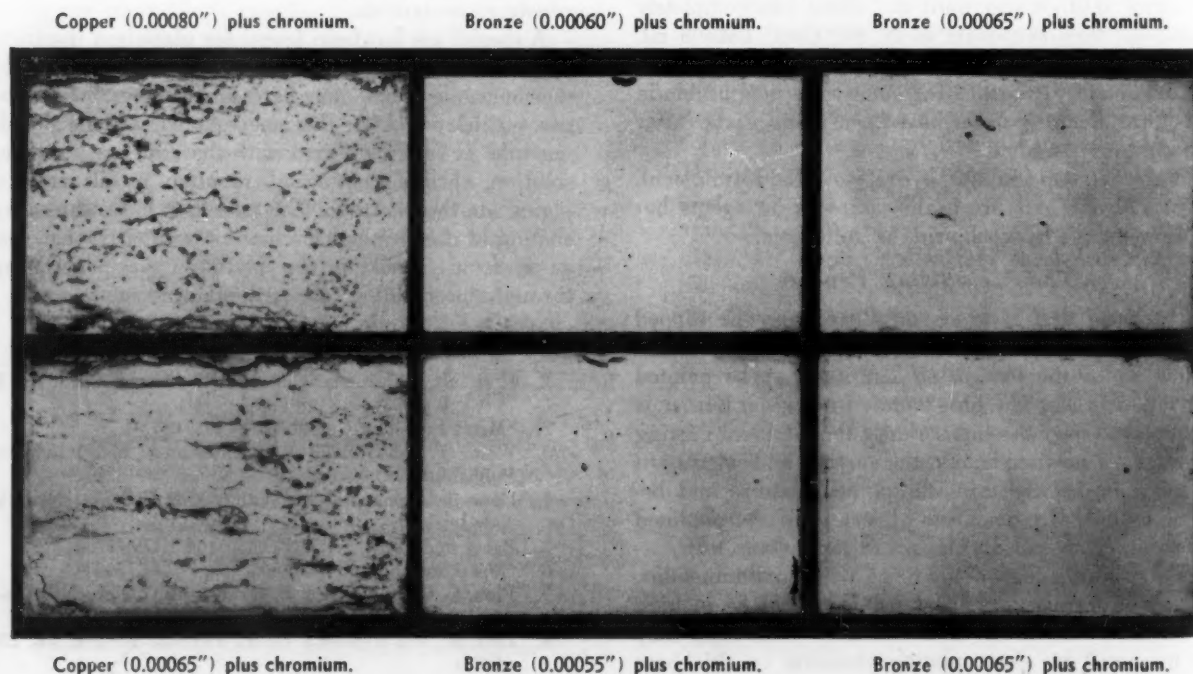
Corrosion Data

Salt-spray and outdoor-exposure tests show that bronze and speculum protected steel better than copper and/or nickel plates. Figure 1 shows representative results of the performance of bronze and copper plates in the salt-spray fog test. Table 1 summarizes the results of the several salt-spray tests.

The outdoor-exposure data also demonstrated the excellence of the bronze plates in protecting steel against rusting. Bronze plated directly with chromium showed no discoloration due to tarnishing of the bronze alloy. Yet, copper plate with an overlay of 0.00005"

*Battelle Memorial Institute, Columbus, Ohio.

Figure 1. Results of salt-spray tests on bronze and copper plates.



**Table 1. Comparison of Bronze and Speculum with
Copper and Nickel Plates in Salt-Spray Fog¹**

Plate	Thickness Inch	Condition After 24 Hours' Testing	Condition After 48 Hours' Testing	Condition After 72 Hours Testing
Bronze (10% tin) ²	0.0005	No rusting	Few rust spots	Few rust spots
Bronze (20% tin) ²	0.0005	No rusting	Few rust spots	Few rust spots
Copper ²	0.0007	Several rust spots	Badly rusted	Discontinued at 48 hours
Bronze plus nickel ²	0.0005	No rusting	No rusting	Few rust spots
	and			
	0.0015			
Copper, plus nickel ²	0.0007	Several large rust spots	Badly rusted	Discontinued at 48 hours
	and			
	0.00015			
Nickel ²	0.00075	Several rust spots	Badly rusted	Discontinued at 48 hours
Nickel ²	0.0010	Few rust spots	Badly rusted	Discontinued at 48 hours
Speculum ³	0.0010	No rusting	No rusting	Few rust spots

(1) Refers to 4"x6" plated steel panels tested in 95°F. salt-spray fog, according to ASTM standards.

(2) Chromium plate, 0.00002" thick, was deposited on these plates.

(3) No chromium was deposited on the speculum.

nickel and 0.00002" chromium was badly discolored with gray-green corrosion products. The results of exposure in a seashore atmosphere for 5 months are given in Table 2. They show that 0.0005" of bronze protected steel better than 0.001" of copper.

The information in Tables 1 and 2 refers to bronze alloy containing 18 to 20 per cent tin and 80 to 82 per cent copper, except for the data specifically noted as relating to bronze alloy with a 10 per cent tin content. The color of the alloy containing 20 per cent tin is golden yellow. The 10 per cent tin alloy is yellow red.

The bronze alloy and the copper plates were buffed

prior to plating with chromium, and the thickness of each plate after buffing was determined with a magnetic tester. The bright-nickel and the bright-speculum-alloy plates did not require buffing. The speculum alloy is white in color, contains 40 to 50 per cent tin and 50 to 60 per cent copper, and closely approaches silver in appearance.

The outdoor-exposure data deal with relatively thin bright-nickel plates over copper or bronze-alloy deposits. The 0.00005" nickel overlay greatly reduced the protection furnished by the bronze or the copper. The plate combination of bronze and chromium delayed

**Table 2. Results of Outdoor-Exposure Tests on Bronze or Copper,
Plus Chromium Plates on 4" x 6" Steel Panels**

Plate	One Month of Exposure	Two Months of Exposure	Three Months of Exposure	Four Months of Exposure	Five Months of Exposure
Bronze (0.0005"), plus 0.00001" chromium.	No rusting or discoloration except for a trace of rust on edges.	Few pinpoints of brown stain, trace of rust on edges.	Few pinpoints of rust, trace of rust on edges.	20-30 rust spots.	20-30 rust spots.
Bronze (0.00075"), plus 0.00001" chromium.	Ditto	No rusting except for slight edge rusting.	No rusting except for slight edge rusting.	Up to 6 rust spots.	Up to 6 rust spots.
Copper (0.0005"), plus 0.00001" chromium.	Many small rust spots.	Many small rust spots.	Many large rust spots.	Many rust spots, plus many gray-green corrosion spots.	More than 100 rust spots, plus >100 gray-green corrosion spots.
Copper (0.00075"), plus 0.00001" chromium.	Ditto	Ditto	Ditto	Ditto	Ditto
Copper (0.001"), plus 0.00001" chromium.	Few small rust spots.	Few small rust spots.	Few small rust spots.	Up to 5 rust spots, plus many gray-green corrosion spots.	Up to 5 rust spots, plus >100 gray-green corrosion spots.
Bronze (0.0005"), plus 0.00005" bright nickel, plus 0.00001" chromium.	No rust.	Up to 25 small rust spots.	Up to 25 small rust spots.	Up to 50 rust spots.	More than 50 rust spots.
Bronze (0.001"), plus 0.00005" bright nickel, plus 0.00001" chromium.	No rust.	No rust.	Up to 5 small rust spots.	Up to 15 rust spots.	Up to 35 rust spots.
Copper (0.001"), plus 0.00005" bright nickel, plus 0.00001" chromium.	Up to 15 rust spots.	Up to 35 small rust spots.	Up to 35 rust spots.	Up to 50 rust spots, plus many gray-green corrosion spots.	Up to 50 rust spots, plus >100 gray-green corrosion spots.

rusting for a longer period than that of bronze plus nickel plus chromium. Analogously, copper plus chromium was better than copper plus nickel plus chromium. The 0.00005" nickel deposits failed to prevent the appearance of copper corrosion products. In this category, the bronze alloy was greatly superior to the copper because the chromium plate, with or without a bright-nickel intermediate deposit, prevented the appearance of bronze corrosion products.

A supplementary set of panels, including nickel plated directly on bronze, is now under outdoor weathering test.

Die castings plated with bright speculum were tested outdoors by attaching them to the front and rear bumpers of several automobiles. Eighteen months of exposure, including two winters of driving on streets occasionally salted for deicing, caused the appearance of a few small black spots of zinc-alloy corrosion products. Similar die castings plated with copper, nickel, and chromium were about equally corroded during the same period. The thickness of the bright speculum was 0.0007", over a 0.0001" copper strike. The total thickness of copper and nickel was 0.0008". The chromium plates were 0.00001" thick.

At each inspection, usually after about three-month intervals, the speculum-plated die castings were covered with a thick film of road soil, whereas the copper-nickel-chromium-plated parts were relatively free of road dirt. The chromium-plated surface evidently did not wet so easily as the bright-speculum surfaces. Much of the road dirt was easily removed from the speculum plate by rubbing it with a wet sponge. However, residual dirt caused a darker appearance, by comparison with the initial condition.

The results of exposing the die castings suggest that bright speculum plus chromium plate would be at least equal to copper plus nickel plus chromium plate in protecting the zinc alloy and in resisting road film.

Plating Baths

Two types of plating baths are known for plating the copper-tin alloys. One contains copper and sodium cyanide, sodium stannate, and caustic soda.⁴ The other is composed of a stannous pyrophosphate complex compound and a copper cyanide complex compound.⁵

Operation with alloy anodes maintains the copper and tin concentrations in the pyrophosphate bath. The anode and cathode efficiencies are about equal, averaging about 60 per cent, based on divalent tin and monovalent copper. Changes in the concentration of the free cyanide and in the bath temperature influence the cathode efficiency and the plating rate. The pH is maintained in the range of 8.5 to 9.8. In this low pH range, little or no carbonate salts are formed, either by the decomposition of the free cyanide or as a result of carbon dioxide absorption from the air.

Platers in charge of operating commercial baths claim that controls are simpler for operating the stannous pyrophosphate solution than they are for operation of bright-nickel baths. By comparison with copper cyanide solutions, the pyrophosphate-cyanide baths exhibits better stability and needs less filtering. Diaphragming or anode bagging has not been required. Costs for bronze plating are slightly less than costs for bright-nickel plating.

The stannous pyrophosphate-copper cyanide bath has been successful in barrel plating. The bronze alloy is being deposited faster in the barrels than copper, brass, cadmium, or tin. Furthermore, the throwing power of the bronze plate is excellent.

Recently, bright-bronze plate has been produced in the laboratory by means of adding a supplementary brightener to the pyrophosphate bath. A pilot-plant evaluation of the bright-bronze plating process is under way, but further checking is required before commercial practicability is certain.

Anodes of copper and tin with two separately adjustable anode circuits are required for operating the stannate bath.⁶ The current supplied to each circuit has to be carefully controlled. Otherwise, the copper and tin anodes are used alternately for short periods, with one set removed from the bath while the other set is being used.⁷ In either case, the tin-anode current density must be carefully controlled to insure the formation of stannic tin. A deficient anode potential causes the tin to dissolve in the stannous form, resulting in rough or spongy deposits. An excessive anode potential causes the evolution of oxygen and arrests the dissolution of the tin.

Plating with insoluble anodes was proposed.⁸ Copper and tin salts were added to replace the consumed copper and tin. Anodic oxidation of the sodium cyanide caused an increase in its consumption. Attempts to develop a commercial stannate bath for bright plating speculum alloy were unsuccessful.⁹

Despite the difficulties of operating the stannate bath, it is being used in England for plating bronze in place of copper and/or nickel for decorative applications.^{10,11} The buffed-bronze deposits is plated with bright chromium.¹² The speculum alloy is also being plated in the stannate solution and buffed to make reflectors with very much better tarnish resistance than silver-plated ware.¹³ Other uses for speculum plate include hardware and tableware.¹⁴ Bronze plating prevents the penetration of nitrogen gas in the nitriding process for surface hardening.^{15,16}

Plating conditions and operating characteristics for the stannate and the stannous pyrophosphate baths are compared in Table 3.

Properties of Bronze and Speculum Plates

Bright-speculum-alloy and semibright-bronze-alloy plates are produced in the pyrophosphate bath but only dull matte deposits are obtained in the stannate solution. In addition to this difference in appearance, the deposits also differ in structure and properties. For example, for protecting steel from rusting in the salt-spray fog test, the bright-speculum-alloy plates produced in the pyrophosphate solution have been superior to the buffed speculum-alloy plates deposited in the stannate bath. The corrosion tests described in the preceding section dealt with speculum and bronze plates deposited in the stannous pyrophosphate-copper cyanide solution because such plates appeared from preliminary studies to be better than the plates obtainable in the stannate solution.

The properties of the bronze plate depends on the alloy composition. Alloy plate containing 7 to 15 per cent tin and 85 to 93 per cent copper is ductile and has

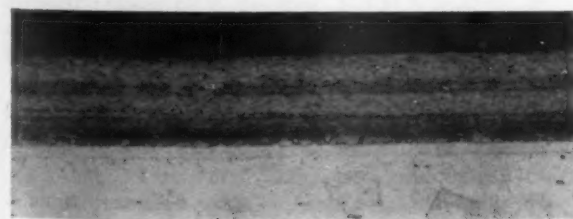
Table 3. Conditions for Plating Bronze and Speculum Alloy

Condition or Characteristic	Sodium Stannate-Copper Cyanide Bath	Stannous Pyrophosphate-Copper Cyanide Bath
Cathode current density, amp./sq. ft.	15 to 25	20 to 70
Cathode efficiency, per cent	50 to 60 (based on Sn^{4+} and Cu^{+})	50 to 70 (based on Sn^{2+} and Cu^{+})
Rate of deposition inch/hour	0.001 to 0.002	0.002 to 0.005
Anode current density, amp./sq. ft.	5 to 10 amp./sq. ft. on copper anodes 15 to 20 amp./sq. ft. on tin anodes	5 to 20 amp./sq. ft. (alloy anodes) or up to 35 amp./sq. ft. with PR
Anode efficiency, per cent	Copper — 50 (based on Cu^{+}) Tin — 80 (based on Sn^{4+})	50 to 70 (based on Sn^{2+} and Cu^{+})
Cu:Sn ratio in bath for depositing speculum (45 per cent tin)	0.2	2.5
Cu:Sn ratio in bath for depositing bronze (10 per cent tin)	1.5	16
Tank voltage	2 to 5	2 to 4
Agitation requirements	Slow work bar	Slow work bar
Temperature, °F.	150	145 for bronze; 180 for speculum
Filtration requirements	Occasional batch treatment	Occasional batch treatment (every 2 to 4 weeks) or continuous
Anode bagging or diaphragming	Not required for thin plates	Not required except for 0.0015" or thicker plates
Ventilation requirements	Same as copper-cyanide bath	Same as copper-cyanide bath
Cyanide consumption	Up to 4 g./L./day	0.5 to 1.0 g./L./day
Caustic consumption	Up to 5 g./L./day	None
Throwing power	Excellent (better than copper-cyanide baths)	Excellent (better than copper-cyanide baths)
Effects of impurities	Stannous tin causes spongelike plate Nickel and cobalt greatly reduce the cathode efficiency Lead and antimony reduce ductility of the plate Oil or grease causes pitting	Stannic tin is not harmful Nickel and antimony cause dark, spongelike plate Lead reduces ductility of the plate Calcium, magnesium, iron, and zinc are not harmful Oil or grease causes pitting

a hardness of 260 to 280 Knoop, which is nearly three times as hard as matte copper plate. This bronze alloy is fine-grained and easy to buff. It may also be electropolished. Clear chromium is deposited on the buffed plate, using the conventional baths for chromium plating. The properties of the plate make it particularly suitable as a bearing overlay, as a stopoff against nitriding, and as an undercoat for decorative plating.

Bronze-alloy plate with a 17 to 20 per cent tin content, balance copper, is slightly harder than the 7 to 15 per cent tin bronze, having a Knoop hardness of 300 to 320. It also has superior leveling power. The leveling power of 0.001 inch of the 17 to 20 per cent tin-bronze alloy is 40 per cent, calculated from the difference in rms microinch readings before and after plating. These leveling characteristics are particularly advantageous for decorative plating. Chromium can be directly deposited over the bronze after buffing it. The 17 to 20 per cent tin bronze is very easy to color buff

Figure 2. Photomicrograph of a 17 to 22 per cent Tin-Bronze Alloy Plate, 0.00125" thick, on low-carbon steel.



500X Etched With An Alcohol Solution of Ferric Chloride and Hydrochloric Acid.

to a mirror brightness. The plates are very fine grained and exhibit a banded structure. A typical metallographic cross section is shown in Figure 2.

The bright-speculum plate is hard, about 400 Knoop. By comparison, silver has a hardness value of only 70 to 120 Knoop. Because of its hardness, speculum offers excellent scratch resistance. It is not sufficiently ductile to be plated on flat stock for subsequent forming. Its metallographic structure is similar to the structure of the section shown in Figure 2.

Bright-speculum plate fills polishing scratches and smoothens imperfections in the basis-metal surface better than the red-bronze deposits. For example, a 20- to 23-rms-microinch surface finish produced by polishing hot-rolled steel with 180-grit emery-coated abrasive belts was smoothed to 7 rms microinches by plating 0.001 inch of the speculum-alloy plate.

Another outstanding property of the speculum alloy is its reflectivity. Bright-speculum plates are 5 per cent more reflective than freshly applied chromium plates on buffed nickel and only 5 per cent less reflective than freshly buffed silver. After only 3 weeks of service, speculum-plated reflectors were three times better than silver-plated reflectors. During 18 months of exposure, the reflectivity of the silver was reduced to only one-tenth the reflectivity value of the speculum.

In addition to reflectors, speculum plate is suitable for indoor use on items such as flatware, holloware, builders' hardware, architectural trim, and appliances

(Concluded on page 78)

Direct Titration of Zinc and Cadmium in Cyanide Solutions

By J. P. Leftin, *Meter and Instrument Laboratory, General Electric Company, West Lynn, Mass.*

THIS paper presents a method for the direct titration of zinc or cadmium in cyanide electroplating solutions. The method is accurate and rapid, a single determination taking in the order of ten minutes, and involves no special equipment.

The primary consideration involved in selecting methods for the chemical analysis of electroplating solutions is speed. The relatively wide variation in permissible concentration of the constituents of a plating bath makes the high accuracy usually required in chemical analysis unnecessary, an accuracy of 5 to 10% being adequate in most cases. From the standpoint of the small plating shop the avoidance of expensive equipment is also an important item. As a result, volumetric methods are employed almost exclusively. The commonly used volumetric methods provide satisfactory control, but in many cases involve operations, such as evaporation, precipitation, and filtration which are time-consuming.

The great demand for zinc and cadmium plating in industry today, together with the requirements for a high quality finish, makes the chemical control of the plating baths used virtually a must. The procedure commonly used for the determination of metal content in these baths, while satisfactory, leave something to be desired. Zinc in zinc-cyanide plating baths is usually determined¹ by titration with potassium ferrocyanide solution using uranium acetate solution as an outside indicator. Aside from the inconvenience of using an outside indicator, a separation involving evaporation, precipitation, and filtration is involved. Cadmium can also be determined by a ferrocyanide titration² in the same way as zinc, but a separation is also necessary involving precipitation and filtration. The ferrocyanide titration of cadmium has proven to be erratic in this laboratory and electrolytic deposition³ is used. This method is accurate and reasonably rapid but involves apparatus for electrolysis including platinum electrodes, which are rather expensive equipment. It was with the view of eliminating the objectionable features of these determinations that this investigation was undertaken.

Table I
Precision of Titration of Pure Zinc

Weight of Zinc	Ml. Titration	Zinc Titer
0.1262 g.	36.90	0.003420 g./ml.
0.1262	36.90	0.003420
0.1262	36.91	0.003419
0.1262	36.88	0.003422
0.1262	36.89	0.003421
	Average	0.003420 g./ml.

The use of ethylenediaminetetraacetic acid (E.D.T.A.) in the so-called "complexometric" titration of a number of cations, including zinc and cadmium, was reported in 1948 by Biedermann and Schwarzenbach.⁴ Flaschka⁵ used the reagent in the selective determination of zinc and/or cadmium in the presence of a number of other cations. An application of the reaction to the determination of zinc in zinc concentrates, brass, and gun metal was made by Kinnunen and Merikanto.⁶ The "complexometric" titration seemed attractive from the standpoint of speed, accuracy, and low equipment cost, and an experimental study was made of its application to the determination of zinc or cadmium in cyanide plating baths. The suc-

Table II
Comparison of Gravimetric and Titrimetric Determination of Zinc

Plating Bath	Analysis of Plating Bath, oz./gal. Zinc Cyanide	
	Gravimetric	Titrimetric
Tank # 1, Zinc Cyanide	6.51	6.48
		6.48
		6.47
		6.51
Tank #2, Zinc Cyanide	6.92	6.87
		6.88
		6.87
		6.90
Tank #3, Bright Zinc Cyanide	12.78	12.82
		12.81
		12.82
		12.82
Tank #4, Bright Zinc Cyanide	9.24	9.17
		9.16
		9.17
		9.17
Tank #5, Bright Zinc Cyanide	10.29	10.35
		10.31
		10.33
		10.31

cessful method resulting from the study is presented below.

Reagents

Di Sodium E.D.T.A. solution, 0.05 molar: Dissolve 18.6 grams reagent grade disodium dihydrogen ethylenediaminetetraacetate dihydrate in 1 liter of water.

Eriochrome Black T indicator solution: It was found convenient to purchase the prepared indicator solution from the supplier.

Formaldehyde solution, 4% by volume: Dilute 1 volume of 36% reagent grade formaldehyde solution with 8 volumes of water.

Table III

Precision of Titration of Pure Cadmium Oxide

Weight of CdO	Ml. Titration	CdO Titer
0.2523 g.	36.70	0.006875 g./ml.
0.2523	36.70	0.006875
0.2523	36.75	0.006865
	Average	0.00687 g./ml.

Standard zinc solution: Accurately weigh 1.25 grams of reagent grade zinc metal, dissolve in 20 ml. of 1:1 hydrochloric acid and make up to 500 ml. in a volumetric flask.

Standard cadmium solution: Accurately weigh 2.5 grams of reagent grade cadmium oxide, dissolve in 30 ml. of 1:1 hydrochloric acid, and make up to 500 ml. in a volumetric flask.

All other reagents used were of reagent grade, and distilled water was used in all cases.

Determination of Zinc

The Di Sodium E.D.T.A. solution was standardized as follows: a 50-ml. aliquot of the standard zinc solution was pipetted into a 600-ml. beaker. Ammonium hydroxide was added until a permanent precipitate formed, followed by a 10-ml. excess. After dilution to 300 ml. with water, 6 drops of indicator were added and the red solution titrated with the reagent solution to a clear-blue end point. The color change was most readily followed by placing the titration vessel on a sheet of white paper and shining the light from a student's desk lamp through the solution from the bank. The precision of the titration is shown in Table I.

The application of the procedure to the determination of zinc in zinc-cyanide plating baths was then investigated. Samples of 5 baths in constant use in the plating department were obtained, 2 zinc cyanide and 3 bright zinc. These baths were carefully analyzed gravimetrically for zinc content. The procedure, briefly, consisted of treating a measured portion of the sample with acid, evaporating to fumes of sulfuric acid, diluting, gassing with hydrogen sulfide, filtering, boiling, gassing again with hydrogen sulfide to remove the last traces of molybdenum, filtering, boiling, adjusting the acidity to 0.01 normal in sulfuric acid, gassing with hydrogen sulfide, filtering, igniting to zinc oxide and calculating to oz./gal. of zinc cyanide present in the bath.

Samples of these same baths were then titrated with standard Di Sodium E.D.T.A. solution. A 5-ml. sample was pipetted into a 100-ml. volumetric flask, made up to the mark with water, and well mixed. A 25-ml. aliquot was pipetted into a 600-ml. beaker, 10 ml. of ammonium hydroxide added, and the solution diluted to 300 ml. with water. Five milliliters of 4% formaldehyde solution and 6 drops of indicator were added, and the solution titrated at once to the blue end point as previously described. A comparison of the gravimetric and titrimetric methods is given in Table II.

Determination of Cadmium

The Di Sodium E.D.T.A. solution was standardized against the standard cadmium-oxide solution in the same way as described for the standardization against zinc. The precision of the titration is shown in Table III.

Sample of four cadmium-cyanide plating baths in constant use in the plating department were obtained, and the cadmium content determined by electrodeposition on a platinum cathode. The cadmium content found was calculated to oz./gal. of cadmium oxide present in the bath.

Sample of the same baths were then titrated with standard Di Sodium E.D.T.A. solution in exactly the same way as described for the zinc-cyanide baths. The comparison of the electrolytic and titrimetric procedures is given in Table IV.

Remarks

The aliquot procedure described was used in proving out the procedure. For ordinary work there is no reason why a 1-ml. sample of the bath could not be used. Better accuracy would, of course, be obtained by using a 5-ml. sample. However, experiments made to determine the effect of excessive amounts of compounds normally present in the baths (cyanide, hydroxide, carbonate, etc.) indicated that such quantities interfered seriously with the titration. The interference was probably due to too high a pH but time did not permit a more rigorous investigation. As a safety factor it was felt that samples of the order 1 ml. should be used.

Conclusion

A rapid, accurate method for the determination of zinc or cadmium in cyanide plating baths has been developed. The saving in time over the conventional procedures is substantial. Depending on the number of determinations to be made, savings of from 15 to 30 minutes per determination can be realized.

Table IV

Comparison of Electrolytic and Titrimetric Determination of Cadmium

Plating Bath	Electrolytic	Titrimetric
#1 Cadmium Cyanide	4.84	4.89 4.89 4.93 4.93
#2 Cadmium Cyanide	4.87	4.84 4.86 4.83
#3 Cadmium Cyanide	3.55	3.58 3.61 3.61 3.61
#4 Cadmium Cyanide	4.65	4.73 4.75 4.75

Literature Cited

1. Modern Electroplating, pp. 372-373, The Electrochemical Society (1942).
2. Ibid, 107.
3. Ibid, 106.
4. Biedermann, T. W., and Schwarzenbach, G. *Chimia*, **2**, 56-59 (1948).
5. Flaschka, H., *Chemist-Analyst*, **42**, #3, 56-58 (1953).
6. Kinnunen, J., and Merikanto, B., *Chemist-Analyst*, **41**, #4, 76-79 (1952).

A Porosity Test for Electrodeposits on Zinc-Base Die-Castings

By H. K. Luiwak *Defence Research Laboratories, Victoria, Australia*

Abstract

A NEW method of determining the porosity of metal coatings on zinc-base die-castings has been developed. It uses a test solution consisting of ammonium chloride and potassium ferrocyanide. The ammonium chloride corrodes the zinc at the bottom of pores and keeps the zinc in solution; the ferrocyanide forms a white, insoluble compound with the dissolved zinc.

Irregularly shaped articles are first given a thin coat of shellac and are then completely immersed in the test solution; white spots grow on the sites of pores in the coating. For testing flat, cylindrical or conical surfaces, the solution may be applied by means of absorbent paper. The white compound shows up well on black paper; alternatively, if the compound is converted to suitably colored salts (*e.g.*, ferric, cupric), white paper can be used.

Introduction

The protection against corrosion afforded by electrodeposited coatings that are cathodic relative to the underlying metal is purely mechanical in nature. If such coatings are porous, they will not only fail to protect the underlying metal, but will sometimes increase the rate of corrosion of the latter. This is particularly true of copper, nickel and chromium coatings applied to zinc-base alloys.

The test most frequently used for determining the porosity of plated coatings on zinc-base alloys is the salt spray test, in which specimens are exposed to salt spray for from 16 to 48 hours (A.S.T.M. Tentative Specification¹). This test is lengthy and destructive, and there is a need for a rapid non-destructive test.

Previous Methods

Bauer, Arndt and Krause² have listed two rapid methods. In the first, preheated specimens are placed in a warm sugar solution containing sodium hydroxide. Gas bubbles appear on the metal surface and are kept in position by the viscous liquid. In the other method, a specimen is treated with an acid copper sul-

phate solution. Copper appears on sites of pores by immersion deposition. A third method is the electrographic method of Hughes³ in which white spots indicating pores in the deposit are developed on black absorbent paper by means of potassium ferrocyanide and applied current. Hughes was somewhat reticent about recommending this method and implied that the acid copper sulphate test was probably superior.

In tests made by the author, Strausser's⁴ finding that small pores are not revealed by either of the methods described by Bauer, Arndt and Krause was confirmed; Hughes' method was found to be equally unsatisfactory.

Ammonium Chloride - Ferrocyanide Method

As it seemed to the author that failure of earlier methods to detect fine pores was due to insufficient corrosion of the zinc at these positions, it was decided to try more efficient corroding agents in combination with potassium ferrocyanide to enable the corrosion to be readily detected.

CORRODING AGENT

The choice of corroding agent was made from sodium, potassium and ammonium chlorides, these being the chlorides for which most information was available. Particular interest was taken in ammonium chloride, the data given by Drucker⁵ suggesting that the corrosion rate with zinc-base alloys would be sufficiently rapid for the purpose in mind.

The corroding action of the three chlorides on zinc panels intentionally plated with porous deposits of copper and nickel was compared. The panels were completely immersed in 1.5 N solutions of the three chlorides and were kept under observation for one week.

In both the sodium and the potassium chloride solutions, the corrosion at the pores of the plated coating was heavily obscured by migration and subsequent deposition of zinc corrosion products, and the solution became markedly turbid. The appearance of the panels corresponded closely with the "point attack" type of corrosion described by Evans.⁶

In the ammonium chloride solution no zinc cor-

Reprinted from Institute of Metal Finishing Bulletin.

rosion product appeared, and the solution remained clear. Throughout the full period of test, gas bubbles were evolved and the smell of ammonia was noticeable; the pH rose from 4.9 to about 7 within three days and then remained constant.

Under completely immersed conditions, no nickel or copper could be detected polarographically in any of the three corroding solutions even after 7 days, showing that corrosion of the plated coatings was negligible. With partial immersion in ammonium chloride solution only traces (2 mg/l) of nickel and copper were found after some days.

POTASSIUM FERROCYANIDE AS AN "INDICATOR" OF PORES

In order to produce a readily visible indication of corrosion at the pores in the coating, the tests described above were modified by the addition of potassium ferrocyanide to each of the three chloride solutions.

In all three solutions the predominant feature was the prolific growth of zinc ferrocyanide "trees" from sites of pores. Initially, the ammonium chloride-potassium ferrocyanide solution behaved similarly to the ammonium chloride solution, but "trees" soon appeared, and gas evolution ceased. The "trees" appeared sooner, and were more numerous than those which appeared in the solutions containing sodium and potassium chlorides. Subsequent tests showed that best results were obtained with a solution containing 80 g./l. each of ammonium chloride and potassium ferrocyanide; the number of spots increased progressively for about 20 minutes and remained constant thereafter.

Using black absorbent paper soaked in this solution, the number and intensity of spots reached a maximum in 8-10 minutes. Further tests showed that the sensitivity of the test for detection of fine pores could not be improved by lowering the surface tension of the solution by means of wetting agents.

It was observed that the spots on the black paper immediately after separation from the test panel were faint, and became intensely white only after some time. Small spots became visible only after the paper was air dried. This increase of the intensity of the spots may be explained by an observation reported by Rupp⁷, who found that gelatinous $Zn_2Fe(CN)_6$ is first formed and then reacts with excess of potassium ferrocyanide forming the denser $K_2Zn_3[Fe(CN)_6]_2$ within 20 or 30 minutes.

DEVELOPMENT OF A PRACTICAL TEST FOR POROSITY

(a) *Use of an Organic Film to "Fix" the Pore Pattern.*—In the course of the above tests on panels, it became clear that it would be necessary to devise some means of preventing spreading and washing away of "trees" during removal of the castings from the testing solution and in the subsequent washing.

It appeared that a thin permeable colorless film should be satisfactory and it was found that a suitable film could be formed by using a dilute alcoholic solution of shellac.

Tests with nickel plated zinc showed that the presence of the film did not diminish the sensitivity of detection of pores. Further tests on electrodeposited chromium surfaces, which are not easily wetted, showed that whereas a shellac-coated surface developed white spots at numerous pores, an immersion test after removal of the shellac revealed no white spots. On re-coating the same specimen, numerous pores were again revealed. The presence of the organic coating is therefore essential to give a true indication of the porosity on chromium plated articles.

The white spots and the shellac film can be removed by wiping the surface thoroughly with a cloth soaked in alcohol.

(b) *Use of Absorbent Paper to Produce a "Print" of the Pore Pattern.*—On flat, cylindrical or conical smooth surfaces (including chromium plated surfaces) the shellac coating was unnecessary as satisfactory "prints" of the white spots were obtained by the use of black absorbent paper which had been soaked in the test solution. Equally satisfactory "prints" were obtained with white paper in which the absorbed white zinc ferrocyanide was colored by immersion of the thoroughly washed paper in acid copper sulphate or ferric chloride solution. The brown and blue colors of the copper and ferric ferrocyanides respectively develop quickly, and the paper can be kept for record purposes after the excess coloring agent is removed by thorough washing.

CHANGES IN THE TEST SOLUTION

The stored, unused test solution became turbid and green in the course of a few days, and its pH rose from 5.7 to 6.6. Used solutions showed the same discoloration and the pH rose to values of more than 7 owing to the formation of ammonia.

Many tests, in which freshly prepared and used but filtered test solutions were employed, showed that these changes in the solutions did not reduce the sensitivity of the test.

Validity of the Method

The method was compared with others mentioned earlier.

A number of panels were tested by the methods described by Bauer, Arndt and Krause², and Hughes³, after which they were immersed in the ammonium chloride—potassium ferrocyanide solutions. In both cases additional pores were found, thus confirming that these earlier methods do not reveal all the pores in the coating.

As the salt spray test is generally accepted as the porosity test for deposits on zinc-base alloys¹, it was studied in some detail. Specimens tested in the salt spray (fog) chamber (A.S.T.M. Tentative Method⁸) were compared with specimens tested by the new method.

A number of plated die-castings were divided into two lots. One lot was first tested by the new method, and then washed thoroughly with alcohol to remove the spots and the shellac film and placed for 48 hours in the salt spray chamber. The other lot was first

placed in the salt spray chamber for the same period of time, then lightly polished to remove firmly adhering zinc corrosion products, and tested by the new method. In the salt spray test, the corrosion products spread over the surface and to some extent masked the location of pores. It was clear, however, that the new method was as sensitive as the salt spray in the detection of porosity, and had the advantage of giving a clear pattern of the number and the location of pores in the deposited metal. Furthermore all surfaces are subject to examination whereas in the salt spray test top surfaces are mostly affected.

Recommended Procedure

SOLUTIONS AND EQUIPMENT

- (a) Dissolve 80 g. of ammonium chloride and 80 g. of potassium ferrocyanide, $K_4Fe(CN)_6 \cdot 3H_2O$, in water at room temperature and dilute to 1 liter. Filter solution that has become turbid before use.
- (b) Cut pulp paper (impregnated with carbon black) as used for wrapping light-sensitive materials, or smooth white paper, to size required by the shape of the specimens.
- (c) Dissolve 10 g. of shellac in 1 liter of alcohol. After standing, decant the clear liquid from the sediment of shellac wax.
- (d) Dissolve 10 g. of ferric chloride, $FeCl_3 \cdot 6H_2O$, in water and dilute to 1 liter.
- (e) Dissolve 200 g. copper sulphate in water, add 30 ml. sulphuric acid and dilute to 1 liter. Alternatively, acid copper plating solution can be used.

DEGREASING

Degrease the specimens in an organic solvent such as benzol or carbon tetrachloride and then clean with magnesium oxide-water paste and rinse.

TESTING OF IRREGULARLY SHAPED ARTICLES

Wash the degreased specimens with alcohol to remove water, then dip them into shellac solution and dry in hot air (avoid flame). Submerge the specimens completely in the test solution for about 20 minutes, then remove them carefully from the solution, rinse and dry. If a permanent record is required, the specimens may be photographed. Clean specimens which have passed the test thoroughly with alcohol before using them commercially.

TESTING OF FLAT, CYLINDRICAL OR CONICAL ARTICLES

Soak the black, or white, paper in the test solution, and shake free from excess liquid. Place the moist papers on the degreased specimens and press the backs of the papers to remove air bubbles. Remove the papers from the specimens after 10 minutes.

- (a) Dry the black papers without rinsing.
- (b) Rinse the white papers thoroughly for about 20 minutes in a stream of running water, until substantially all test solution absorbed by the paper has been washed out. Immerse the papers

in either the ferric chloride or the copper sulphate solution and rinse and dry the papers after the colored spots have appeared.

The test papers are permanent records.

Acknowledgments

The author is indebted to Mr. J. J. Dale for helpful advice during the course of this work and to the Chief Scientist, Department of Supply, Australia, for permission to publish this paper.

References

1. A.S.T.M. Specification B142-45T "Electrodeposited Coatings of Nickel and Chromium on Zinc and Base Alloys," 1945.
2. Bauer, O., Arndt, H. and Krause, W., "Chromium Plating," 1935, pp. 110-111, London: Arnold.
3. Hughes, H. D., "Electrography Applied to the Examination of Electrodeposits," *J. Electrodepositors' Tech. Soc.*, **20**, 17-30, 1944-45.
4. Blum, W. and Hogaboom, G. B., "Principles of Electroplating and Electroforming," 1949, p. 144, N.Y.; McGraw Hill.
5. Drucker, C., "The Action of Ammonium Chloride on Zinc (Dry Cell)," *Z. Electrochem.*, **29**, 412-15 (1923).
6. Evans, U. R., "Metallic Corrosion, Passivity and Protection," 1948, pp. 359-60, London: Arnold.
7. Rupp, E., "The Determination of Zinc by Means of Potassium Ferrocyanide," *Chem. Ztg.*, **33**, 3-4 (1909).
8. A.S.T.M. Tentative Method B117-49T, "Salt Spray (Fog) Testing," 1949.

BRONZE AND SPECULUM PLATES

(Concluded from page 73)

where the temperature of the plated surface does not exceed about 225°F.

Acknowledgments

The authors acknowledge with appreciation the permission of the City Auto Stamping Co. and Battelle Memorial Institute to publish this paper.

References

1. Kremann, R., German Patent 267,718 (December 7, 1912).
2. Ireland, J., *Materials and Methods*, **22**, 1400-1402 (1945).
3. Peters, F. P., *Scientific American*, **174**, 207-209 (1946).
4. Batten, H. M., and Welcome, C. J., U. S. Patent 1,970,549 (August 21, 1934, to City Auto Stamping Co.)
5. Patents covering this process are pending in the United States, Canada, and England.
6. Baier, S. W., and MacNaughton, D. J., U. S. Patent 2,511,395 (February 29, 1945, to City Auto Stamping Co.)
7. Baier, S. W., U. S. Patent 2,397,522 (April 2, 1946, to City Auto Stamping Co.)
8. Lowenheim, F. A., U. S. Patent 2,528,601 (November 7, 1950, to Metal and Thermit Corp.)
9. Bennett, P. S., *J. Electrodepositors' Tech. Soc.*, **26**, 107-118 (1950).
10. Schermling, G., *Electroplating*, **5**, (4), 115-118, 123 (1952).
11. "Substitutes for Nickel," *Electroplating and Metal Spraying*, **5**, 301 (November, 1952).
12. Duc, F. S., *Electroplating*, **5**, (4), 123 (1952).
13. Hedges, E. S., and Cuthbertson, J. W., *Chemistry and Industry*, 1250-1254 (1952).
14. Ireland, J., *Metallurgia*, **35**, (12), 97-100 (1946).
15. Struyk, C., *The Monthly Review*, A.E.S., **33**, 394-398 (1946).
16. Coe, E. S., *Iron Age*, **167**, 86-88 (June 14, 1951).



APRIL, 1954

LEA COMPOUND

A greaseless composition for polishing, buffing, burring and satin finishing.

Lea Compound is a greaseless composition containing an abrasive or mixture of abrasives bonded together with glue. When applied to a revolving wheel sufficient heat is generated by friction to cause the compound to melt and be transferred to the wheel. Almost immediately it dries or sets up, forming a dry, abrasive-coated wheel with a flexible surface. The use of Lea Compound provides a short cut between polishing and buffing, eliminating polishing wheels in the finer numbers and



rendering easier the job of buffing and coloring.

Lea Compound is not limited to rigid polishing wheels but can be successfully applied to cloth, leather and string wheels of any degree of flexibility. On sewed muslin buffs, pocketed buffs, full-disc loose buffs, packed buffs and string wheels, a degree of flexibility never approached by the conventional set-up wheel is available to the operator.

While the abrasive grains are held securely to the surface of the wheel, the extreme flexibility of the wheel combined with the thin layer of abrasives avoids holding the grains in a rigid position. Therefore, they do not cut as deeply into the surface as grains of a set-up wheel would. Flexibility of the Lea Compound wheel cushions the cutting action of the abrasive grain, whereas with conventional polishing wheels this effect can be obtained only by the use of excessive lubrication.



LEAROK

A no-free-grease buffing composition for high lustre or mirror finishing. A special process developed by Lea Technicians has resulted in the production of Learok buffing and coloring compositions containing no-free-grease. This process of manufacture enables the production of compounds differing materially from the ordinary type of buffing and coloring compositions which contain excessive amounts of grease not absorbed by the abrasive powders. Having no-free-grease to transfer back from the work, the use of Learok eliminates the necessity of scrubbing or excessive cleanings.

Savings are particularly noticeable when work containing contours, ornamentalations or filigreed decorations is being buffed, or when work such as drawn shells, which must be handled on chucks, is being finished. Learok may be used on such materials as aluminum, brass, carbon steel, copper, hard rubber, nickel alloys, pewter, plastics, stainless steel, sterling silver, etc.

OTHER LEA PRODUCTS INCLUDE

LEA LUBAR... a bar form lubricant for polishing wheels and belts where glazing is not a problem.

LEAN GRAIN LUBAR... a special bar form lubricant to eliminate glazing on polishing wheels and belts.

LEA LIQUALUBE... a water soluble liquid lubricant for polishing wheels and belts; can be sprayed or brushed on.

AD-LEA-SIVE... glue base adhesive for sizing buffing and polishing wheels and belts prior to the application of Lea Compound.

LEABRAMENT... greaseless, non-flammable, quick drying liquid abrasive, for burring and polishing; can be sprayed or brushed on the wheel.

LEA LIQUABRADE... clean working, fast cutting and mirror finishing liquid buffing compounds providing in effect continuous operation and substantial economies in composition and buffs; clean and safe, non-inflammable, non-explosive; many abrasive types and grain sizes for all ferrous and non-ferrous metals, steel, stainless alloys, or plastics.

LEA SYNSTRIP... a high speed liquid stripper for synthetic enamels and other organic coatings; leaves non-ferrous surfaces smooth; no etching.

LEATARDENT... anti-stain, dipping emulsion; prevents staining and tarnishing of plated surfaces.

LEA ANALYTICAL METHODS... platers' short-cut methods for analyzing plating solutions.



THE LEA MANUFACTURING CO.
16 CHERRY AVE., WATERBURY 20, CONN.

Lea-Michigan, Inc.
14066 Stansbury Ave., Detroit 27, Mich.
Lea Mfg. Company of Canada, Ltd.
370 Victoria St., Toronto 2, Canada

Lea-Ronal, Inc.
Main Office and Laboratory
42-48 27th St., Long Island City 1, N. Y.
Manufacturing Plant
237 East Aurora St., Waterbury 20, Conn.

LEA GRIPMASTER®

POLISHING WHEEL CEMENT

matching the high quality of other Lea Products, is now obtainable through

LEA-MICHIGAN, INC.

14066 Stansbury Ave., Detroit 27, Mich.

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Cracking of Plated Steel

Question: We read with interest your editorial "Hydrogen Embrittlement" in the August issue. We are manufacturers of spark plugs and produce a couple of premium lines which are bright plated with copper, nickel and chromium. Our plugs are of one-piece construction, which means the steel shell is formed or "crimped" over the insulator upper gasket seat under hydraulic pressure and with considerable heat. Consequently, the steel shell is under substantial tensional stress.

The scarcity of steel in the last several years has made it difficult to obtain, at times, the quality necessary to withstand first, the cold forming and second, the hot sealing of our plugs. Even without plating we have had trouble with cracked shells from time to time.

The plating process, with attendant intermediate pickling and cleaning operations, has increased our rejections. The insidious aspect of this problem is that cracks may open up at relatively long intervals after final inspection, packaging and shipping. In other words, the defects may become apparent only after they are in customers' stocks. We have laid the responsibility for this condition to hydrogen embrittlement induced by pickling, plating, or both. We should appreciate from you an expression of your opinion of our diagnosis.

J. E. D. M.

Answer: We wouldn't place too much blame on hydrogen embrittlement in this particular case. Low carbon steel is formed after plating in numerous applications without trouble. The plating operations will undoubtedly increase the stresses in the steel

so that any incipient failure will be magnified, but we would look into the condition of the steel before it gets to the plating room, especially its drawing characteristics and ductility.

Have you tried annealing the steel after cold forming? The forming stresses would be the most obvious source of failure.

Hardness of Chromium

Question: On behalf of several people trying to settle a dispute over some problems, I took the liberty of writing to you in order to get some authoritative data and answers to the following questions. How does an industrial (heavy) chromium plated surface compare in hardness and wear to (a) Carboly, (b) chromium vanadium steel, and (c) heat treated steel? How does each stand up under impact?

L. A.

Answer: Chromium is harder than heat treated steel and chromium-vanadium steel. It is almost, but not quite, as hard as cemented carbides, nor will it wear as well. Chromium plate does not stand up well under impact.

Bright Dip for Iron

Question: In re-reading our November and December, 1952 copies of Metal Finishing, we have discovered a two-part article entitled "A Non-Electrolytic Smoothing Treatment for Steel," written by W. A. Marshall. If you should know of a firm using this process, would you send us their address. We would also like to know where to contact Mr. Marshall.

D. O.

Answer: Mr. Marshall can be reached at the Armament Research Establishment, Woolwich, England.

A modified form of this solution is

marketed under the name of Mirror by MacDermid, Inc., Waterbury 20 Conn.

Control of Acid Dips for Aluminum

Question: We are presently using a bath consisting of one part nitric acid (42°B) and two parts of water for cleaning aluminum parts prior to anodizing. Is there any simple procedure which we can use to tell when this bath has become exhausted?

In addition, we are considering using a bath consisting of one part hydrofluoric and three parts nitric acid for the purpose of removing silicon and silicon smut from aluminum castings. Although we have not started to use this bath, I anticipate difficulty in determining when this bath has become exhausted. Again I ask, is there any simple procedure for determining the end point for this bath?

K. F. C.

Answer: Ordinarily, the nitric acid bath used for cleaning aluminum prior to anodizing is considered exhausted when it doesn't remove the smut from the cleaning or etching operation in a reasonable time. A simple titration with standard alkali should be satisfactory for control purposes.

We know of no simple method for controlling the nitric-hydrofluoric etch except by chemical analysis. Here again, exhaustion would be indicated by slowing down of the reaction.

Welded Tubing

Question: When we plate welded tubing, spots appear along the weld. Is this a fault of our plating or is it in the metal?

M. M.

Answer: Cyanide spotting along the weld seam on plated tubing is quite common. This is due to inclusions and pores in the weld, and our suggestion is to bake the tubing for about 15 minutes at temperatures of 225 deg. F. before lacquering in order to dry out the pores. The tubing should be lacquered as soon as the temperature drops.

Descaling Cast Iron

Question: Can you advise us of a practical method for pickling or descaling cast iron which will yield a clean, carbon-free surface suitable for plating? We are experiencing difficulty in cleaning ductile iron castings prior to zinc plating.

Our present procedure involves ordinary sand blasting to remove scale. However, because the color and appearance of the scale are the same as the iron, the operator has difficulty in determining when the castings are completely free of scale. The scaled surfaces are not apparent until after zinc plating, when they appear as dark areas.

D. H. S.

Answer: Fused caustic baths containing various additions such as oxidizing agents are considered most suitable for this purpose. There are three processes of this type on the market: the Kolene No. 4 process of the Kolene Corp., the Virgo Process of Hooker Electrochemical Co., and the sodium hydride process of du Pont.

We would suggest that you communicate with these firms for details, since the processes are patented.

Plating With and On Cadmium

Question: Can you advise what metals from the following group can be plated directly over cadmium plate? Copper, nickel, decorative chromium and hard chromium, zinc, silver, tin, lead and iron. Also, conversely, can you advise which metals in the above group can be plated directly with cadmium?

M. S.

Answer: All the metals mentioned can be applied to cadmium and cadmium can be applied to all these metals. It is only a matter of using the proper solution. For example, an acid copper or lead bath would not be suitable, but a cyanide copper and alkaline lead bath would.

The matter may be more complicated from a practical production standpoint, however, since a number of suitable plating solutions are not commercially available and the possibility of forming low melting alloys with metals like lead and tin cannot be ignored.

Antique Gold Smuts

Question: In your 1954 METAL FINISHING Guidebook, under the title "Russian Antique" Gold Plating, the

author mentions producing the smut from any of the several base metal smut solutions. We would appreciate the formulas on the base metal smut solution and operating conditions.

J. L.

Answer: The arsenic plating solution described in the 1954 edition of the METAL FINISHING Guidebook is suitable for producing a smut for antique gold. A cyanide copper plating solution, operated at 6 volts and room temperature with no free cyanide will also produce a satisfactory smut.

Relieving in a Barrel

Question: On page 283 of the 1953 Annual Guidebook-Directory are formulae for antique gold solutions. Can you supply the writer with a formula for an antique copper solution, giving all pertinent information, such as equipment needed, etc.

We are interested in an antique copper solution where there is no rubbing off by wheel involved. In other words, we would like an antique copper solution that can be tubbed off after plating. Any information you can give us along these lines would be greatly appreciated.

L. C.

Answer: On pages 432-445 of the 1953 edition of the Guidebook you will find a section on coloring of metals. It is quite difficult to relieve an antique finish on copper by tubing, since it is quite hard. However, it can be done by tumbling with deburring media to produce the highlights, which can then be burnished, if desired. Most plating supply firms can furnish you with suitable equipment and tumbling media.

Plating on Magnesium and Molybdenum

Question: We would appreciate knowing if there is available any information on chrome plating magnesium and/or molybdenum, or information where this data may be obtained.

S. M. F.

Answer: A section on the subject of plating on magnesium will be found in the latest edition of the Guidebook-Directory, page 226. This describes the only commercial method.

An article on plating on molybdenum appeared recently by A. Korbelak in "Plating," Vol. 40, p. 1126, Oct. 1953. You may be able to obtain a copy of this article by writing to the magazine at 445 Broad St., Newark 2, N. J.

PROFESSIONAL DIRECTORY

HENRY LEVINE & SON, Inc.

Metal Finishing Consultants
Analysis of all electroplating solutions
Engineering of finishing installations
Air Force Certification Tests
Salt Spray Thickness and Adhesion Tests
153 East 26th St., New York, N. Y.
Murray Hill 5-9427

DEVELOPMENT AND CONTROL OF PLATING PROCESSES

Laboratory and 6000 Gallon Pilot Plant
JACQUES L. BROAD & ASSOCIATES
522 N.E. 1st Avenue
Fort Lauderdale, Florida

THE ANACHEM LABORATORIES

TESTING ANALYSIS ENGINEERING
For Metal Finishers
Plating solution analyses and control. Testing of deposit-thickness, composition porosity, tensile strength. Salt Spray tests.
AIR FORCE CERTIFICATION TESTS
1134 Firestone Blvd., Los Angeles 1, Calif.
PLesant 1-4242

CONSULTING ENGINEERING SERVICES

E. J. Hinterleitner, E.Ch.T., and Associates
405 South Ave. - FANWOOD, New Jersey
Tel.: Fanwood 2-5000
P. O. Box 132 - WESTFIELD - New Jersey

SCIENTIFIC CONTROL LABORATORIES

Finishing Consultants—Registered Engineers
Salt Spray—Thickness Testing—Analyses
PLANNING—RESEARCH—DEVELOPMENT
HAYmarket 1-2260
600 BLUE ISLAND AVE., CHICAGO 7, ILL

G. B. HOGABOOM JR. & CO.

Consulting Chemical Engineers
Metal Finishing — Electrodeposition — Solution analyses. **AIR FORCE CERTIFICATION TESTS** — Salt spray, thickness of deposits, adhesion.
44 East Kinney St. Newark 2, N. J.
Market 3-0055

PLATERS

TECHNICAL SERVICE, Inc.

ELECTROPLATING AND CHEMICAL ENGINEERS

- Air Force certification tests
- Salt Spray, thickness and adhesion tests
- Spectrographic analysis
- Solution, Metal and Salt analysis
- Plant Design and Engineering
- Plant layout and construction
- Industrial waste and water supply treatment

NEW YORK LABORATORY 59 East 4 St., New York 3
ORegon 3-6256
CHICAGO LABORATORY 500 S. Wabash Ave.,
Chicago 5
HArrison 7-7648

TECHNIC INC.

products

Technic Potassium Gold Cyanides Concentrated Aqueous and Dry
Technic Alloys for the Production of all Decorative Shades
Technic Rhodium Concentrates for Heavy and Decorative Plating
Technic Immersion Tin for Fast Non Electrolytic Tinning of Brass and Copper
Technic Protectox-Antitarnish Treatment for Precious Metal and Copper Surfaces
Technic Flame Flux for Hard Soldering without Oxidation
Plating Equipment and Rectifiers for all Specialized Requirements

services

Custom Designed Controls Custom Developed Solutions
Custom Designed Equipment
Custom Consulting & Laboratory Service
Custom Engineering & Analytical Service

performance

Technic Inc. researches and develops methods and products for metal processing and finishing. We do not process or finish metals ourselves, but as consultants and suppliers we enable our patrons to perform these operations more efficiently and economically. Among the operations we can equip you to do better at lower cost are:

Controlled Color Gold Plating Controlled Barrel Gold Plating
Controlled Heavy Gold Plating Controlled Specification Gold Plating
and
Controlled Rhodium Plating

TECHNIC INC.



39F Snow St., Providence, R. I.

THE LARGEST ENTERPRISE OF ITS KIND IN THE WORLD

ABSTRACTS

The following papers, of which a brief notice is given here were read at the Electroplating Meeting of the German Metal Sheet Technical Section (Gemeinschaftsveranstaltung der Forschungsgesellschaft Blechverarbeitung) held at Schwab. Gemuend, Germany, November, 1953. As will be seen, a wide range of subjects pertaining to electroplating practice were dealt with and a fuller notice will be given of some of the more important papers in subsequent issues of METAL FINISHING.

Electroplating Alloys

By E. Raub

Electroplated alloys often differ in

their characteristics very considerably from the cast and recrystallized alloys of the same composition. The special properties of the electroplated alloys accordingly arrive at the circumstances that their condition often deviates very greatly from that of thermodynamic equilibrium. Independent of this fact, however, there often occurs by virtue of the simultaneous codeposition of non-metallic foreign bodies, lattice disturbances which can exert a considerable influence on the properties of the deposited alloys.

Definite relationships can be ascertained between the structure of the electrodeposited alloys and the electroplating conditions. The practical possibilities of electroplated alloy deposits were then dealt with in detail.

Alloy Formation by Subsequent Diffusion of Electrodeposited Metals

By G. Woerwag

Electrodeposited metals are characterized throughout from the base metal by sharp separation surfaces. Generally speaking, it is not possible to discern diffusion between the base metal and the plated deposit, after removal from the plating bath. By means of heat treatment at suitable temperatures, simultaneous diffusion can be promoted between the base metal and the deposit and, accordingly, the formation of alloys, provided that the metals concerned are capable of diffusion. In this way it is possible to bring the electroplated coatings into such a condition that the metal coating closely approaches that obtained by mechanical coating or immersion in the molten metal. The author then dealt in detail, by means of selected examples, with some technically interesting questions of the diffusion of plated metal coatings.

Activated Carbon in Electroplating Practice

By B. Wullhorst

The absorptive capacity of activated carbon is utilized in the purification of electroplating baths. Absorption cleaning by means of activated carbon is confined not only to finely divided solid or liquid materials but it embraces also the inorganic and organic compounds which are present in the colloidal condition. In this way, treatment by activated carbon also exerts an undesired influence on the brightening and wetting addition agents of the bath apart from its true function, which is the removal of bath impurities. The effect of activated carbon on different baths in plating practice was then discussed by means of examples.

Electrolytic and Chemical Polishing as a Pre-Treatment for Plating

By B. Wullhorst

The author showed the characteristic difference between mechanically polished, and anodic and chemically polished metal surfaces. The reflective capacity of anodically polished surfaces, lies under some conditions, higher than that obtained after mechanical polishing, although the con-

dition of the mechanically polished surface, observed with the naked eye, would appear to be optically perfect. Anodic polishing does not remove the microscopic surface defects. Chemical polishing is always inferior in its effect to anodic polishing, as regards the quality of the surface obtained. With anodic polishing, there are formed, however, multiple cover coatings of metal salts or oxides, which affect in some cases, the formation of adherent plated coatings. With the chemical polishing of copper alloys, cover coatings are not formed and no unfavorable effect is accordingly exerted on the subsequent plating stage.

The Properties of Electroplated Silver in Relation to the Plating Conditions

By P. Walter

With the electrolysis of aqueous solutions, the metals generally crystallize at a temperature which lies far below the temperature of active internal position exchange. Accordingly, all disturbances of the crystal lattice structure, which occur during the crystallization in the plating bath, remain fixed. The condition which is found with the electrodeposited metals is in many cases, similar to that of the cold-worked metals. This analogy becomes apparent in the mechanical properties, the relaxation and recrystallization characteristics of the electroplated metal.

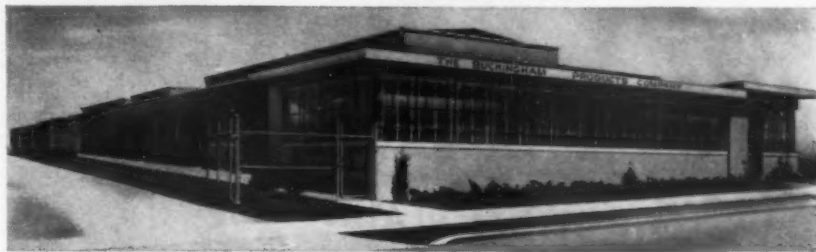
A clear relationship of the properties of the electroplated metal to the total polarization with the deposition cannot be discerned; on the other hand, quite obviously, the reaction polarization is of definite influence on the properties of the electroplated metal.

Bright Plated Deposits

By E. Raub

Our knowledge regarding the mechanism of the formation of bright metal plated coatings is still very incomplete. It is known that the additions to the plating bath, which lead to the formation of bright coatings are co-included in ascertainable amounts, in the deposited metal. This can also apply both to addition agents of metals as also of inorganic compounds. With the occlusion of the foreign bodies, not only does the deposition form change, but also the structure of the

**Complete, Modern Facilities Assure You
The Utmost in Quality and Service on**



- Stainless Steel Composition
- White Finish
- Tripoli
- Chrome Coloring Composition
- Greaseless Composition
- Emery Cake
- Brass Coloring
- Emery Paste
- Burring Compound*
- Grease Stick
- Spray Pastes Stainless Steel Tripoli

Representation in Major Cities

Write Dep't. A for Samples

The BUCKINGHAM PRODUCTS Co.
14100 FULLERTON AVE. • DETROIT 27, MICH.

metal deposit. The remaining properties often also undergo simultaneously quite characteristic changes.

A clearcut connection between the composition and structure of organic brighteners and their effect in the plating baths cannot be established.

Relation between Separation Conditions and Structure of Electroplated Nickel and Copper Coatings

By H. Fischer and J. Elze

After a brief discussion of previous research on this subject, the inhibition theory of H. Fischer was discussed as enlarging our knowledge on this subject. The researches of Fischer regarding the influence of inhibitors on

the structure of electrodeposits has provided very general broad knowledge in this field; previously the effects of temperature and current density appeared to provide no very clearcut significance. An attempt was made to explain what are, at first sight, the conflicting test results with the cathodic deposition of nickel and copper as regards the influence of temperature and current density on the basis of the so-called "secondary" inhibition. A satisfactory confirmation of the inhibition theory was obtained.

Problems of Overvoltage with Electrolytic Hydrogen Separation

By L. Kandler

The fact that the electrolytic hydro-

WE OFFER
25 YEARS EXPERIENCE

BULK CHROMIUM PLATING

Screws, Rivets, Bolts, Nuts, Washers, Eyelets,
Small Stampings, Shells, Turnings, Wire Items, etc.
All Machine Screws Gage checked and Plated to Gage Fit.

HIGH LUSTER

ROLLED OR BUFFED FINISHES

Automatic Buffing of Screws, Shells, Caps.

ALL PLATING INSPECTED

Rejects refinished and work returned complete.
Will stand Crimping and Bending.
Plating controlled to Dimensional Tolerances.

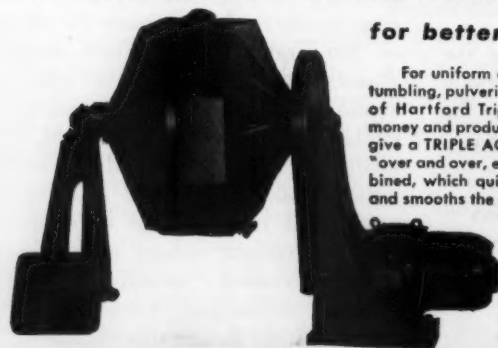
SPECIFICATION PLATING

Plating thickness and Corrosion Resistance assured by
Magna-Gage and Microscopic Thickness Tests and Salt Spray.
Complete Laboratory Control.

The **CHROMIUM PROCESS Company**
SHELTON, CONNECTICUT

Assistance gladly rendered on Dimensional Allowances or other
Plating Problems. No Obligation. Samples plated without charge.

HARTFORD TRIPLE ACTION CUTTING and TUMBLING BARRELS



for better work in less time!

For uniform cutting down, wet or dry grinding, tumbling, pulverizing and mixing, the unique design of Hartford Triple Action Barrels saves time and money and produces better results. Hartford Barrels give a TRIPLE ACTION in tumbling the material, an "over and over, end to end, folding-in" motion combined, which quickly grinds off burrs, and finishes and smooths the general surface of any article in the load. These barrels are available in two sizes, large and small, and with both motor and belt drive. Hartford also makes steel burnishing balls scientifically correct in design and material for each specific job. Bulletin on request.

2H552

THE HARTFORD STEEL BALL CO. HARTFORD 6, CONN.

DETROIT
W. S. TURNER
445 NEW CENTER BLDG.

CHICAGO
VICTOR R. CLARK
609 W. WASHINGTON BLVD.

NEWARK, N. J.
GUARANTEE TRUST BLDG.
972 BROAD ST.

LOS ANGELES, CAL.
E. D. MALBY CO.
1718 SOUTH FLOWER ST.

EXPORT
R. A. RODRIGUEZ, INC.
55 W. 42ND ST., NEW YORK

gen separation also results with potentials which are more negative than corresponds to the reversible potential, up to now has not been entirely explained. The overvoltage is designated as the potential difference between a "working" hydrogen generating electrode and a static reversible electrode and by which the static electrode is immersed in a hydrogen ion containing electrolyte. The extent of the overvoltage depends in a dominant manner on the kind of metal, current density, surface property and activity.

The complete phenomenon of the cathodic hydrogen separation occurs in stages. Regarding the significance of the overvoltage phenomena on commercially important processes, the author discussed in detail this aspect.

The Formation of Metal Films Which Show Interference Colors, During Electroplating

By A. Kutzelnigg

It is shown that during deposition, films can be formed which show the colors of thinner films in the film thickness range of 0.03 and 0.6 microns. Such films were observed in the Hull cell during chrome and bright nickel plating and further by the action of complex silver solutions on brass and by the deposition of thin iron coatings on brass.

As even a relative few atom layers can cause a coloration by interference, the systematic observation of the color of thin metal coatings can have interest for the investigation of the first stages during deposition.

Electropolishing and Materials

By J. Heyes

After a review of the historical development of this new field of metal finishing practice, the two mainly applied types of electropolishing electrolytes were then discussed as regards their advantages and disadvantages. The removal of the surface structure of metals was discussed and the influence of electropolishing on the fatigue strength, corrosion, light reflection as well as on friction and wear.

Practical Aspects of the Separation of Tin Alloy Deposits

By J. Korpium

Types of plating baths have become

known which allow of the electro-deposition of tin alloys. These processes were studied under commercial conditions. Details were given of the characteristics involved in the bath operation and as regards the properties of the alloys deposited with respect to possible applications in commercial practice. The results of the research work conducted covered copper-tin, zinc-tin, nickel-tin and lead-tin alloys.

PATENTS

Cyanide Plating Bath

U. S. Patent 2,654,702. Oct. 6, 1953.
H. K. De Long, assignor to The Dow Chemical Co.

In a method of depositing an electroplate of a metal selected from the group consisting of copper, silver, and gold upon articles of magnesium and magnesium alloys from an aqueous alkaline cyanide plating solution having a pH of 9 to 13 and containing a cyanide of one of the metals selected from the group consisting of copper, silver, and gold and from 2 to 5 grams per liter of CN provided by an alkali metal cyanide by electrolyzing the solution with the article as cathode whereby the selected metal is electro-deposited on the article, the improvement which consists in dissolving in the plating solution a water-soluble inorganic fluoride selected from the group consisting of the alkali metal and ammonium fluorides in amount from 5 to 100 grams per liter of the plating solution.

Etching Aluminum Using Hexahydroxyheptanoic Acid as a Modifier

U. S. Patent 2,653,861. Sept. 29, 1953.
W. R. Meyer, assignor to Enthone, Inc.

An aluminum-etching solution consisting of water and from 0.5% to 35% by weight of the composition of claim 1.

The process of etching a metal article consisting principally of aluminum which includes the steps of cleaning the article, preparing the solution of claim 6, heating said solution to a temperature between 60° and 190°F., subjecting the article to said solution for a period from 5 to 3,600 seconds,

NOW



FLAT TOP ZINC ANODES from Certified 99.995+ % PURE VIRGIN ZINC

When you buy New Jersey Metals zinc anodes, you get *all* pure virgin metal with anode quality control that assures you of the following major benefits:



FULL VALUE No dross or hidden losses. You pay no more for top quality.



BETTER PLATING No pits or blow holes to carry the dirt and contaminants that cause sludge and inferior work.



EASIER HANDLING No gates or flash on their smooth surfaces to catch and stick.

TWO POPULAR STYLES

Choose the new flat top shape for distinctive form that avoids confusion with cadmium anodes . . . plus a snug fit for your anode baskets, or New Jersey Metals popular zinc *ball* anodes that provide the greatest plating surface per pound of anode. Fit either ball holders or anode baskets.

Either shape . . . you can rely on zinc anodes that facilitate faster production . . . that help your plating meet the critical test of dimensional accuracy and excellent surface finish.

Consult New Jersey Metals Co. on *all* your anode requirements. *Flat Top Zinc Anodes. Zinc Ball Anodes. Nickel Anodes.* For quotations and information . . . call ELizabeth 2-6465 . . . or write:

New Jersey Metals Co.

Serving industry from coast to coast since 1920

714 ROCKEFELLER ST.,

ELIZABETH 2, N. J.



a special message
for manufacturers
of military
equipment



need a finish to beat these specs?

specify **IRIDITE**®

AN-C-170 MIL-S5002 MIL-C-5541 AN-P32
AMS-2402A USA-50-80-11A J.Q.D. No. 144B
USA 57-93-2A O.S. No. 1374 USA 57-0-2C AN-P61
A-XS-1607 QQ-P-416 QQ-Z-325 MIL-3151 —
if you're finishing under these or similar specifications,
here's how you can use Iridite:

ON ZINC AND CADMIUM you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.

ON COPPER... Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.

ON ALUMINUM Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.

ON MAGNESIUM Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

WANT TO KNOW MORE? We'll gladly treat samples or send you complete data. Write direct or call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

ALLIED RESEARCH PRODUCTS
INCORPORATED

4004-06 E. MONUMENT STREET • BALTIMORE 5, MD

Manufacturers of Iridite Finishes for Corrosion Protection and
Paint Systems on Non-Ferrous Metals, ARP Plating Chemicals,
WEST COAST LICENSEE: L. H. Butler Co.

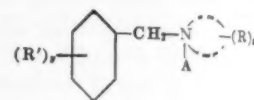


and rinsing residual solution from the article.

Bright Nickel

U. S. Patent 2,654,704, Oct. 6, 1953.
H. Brown and L. B. High, assignors
to The Udylyte Corp.

A bath for the electrodeposition of bright nickel comprising an aqueous acidic solution of a material selected from the group consisting of nickel chloride, nickel sulfate, nickel fluoborate, a mixture of nickel chloride and nickel sulfate, a mixture of nickel fluoborate and nickel chloride, a mixture of nickel fluoborate and nickel sulfate, and a mixture of nickel sulfate, nickel chloride and nickel fluoborate, said bath also containing, in solution, not more than about 1.5% of at least one brightener selected from the group consisting of organic sulfonamides, sulfonimides, and sulfonic acids, and, in addition, about 0.003 to 0.08 gram per liter of a bath-soluble compound in accordance with the formula.



where



represents a compound of the quinoline series selected from the group consisting of quinoline, isoquinoline and C-methyl and ethyl homologues thereof, A is an anion of a water-soluble acid, R is halogen, R' is a member selected from the group consisting of halogen, nitro, methyl and fluoro-methyl groups, and x and y are each zero to 2.

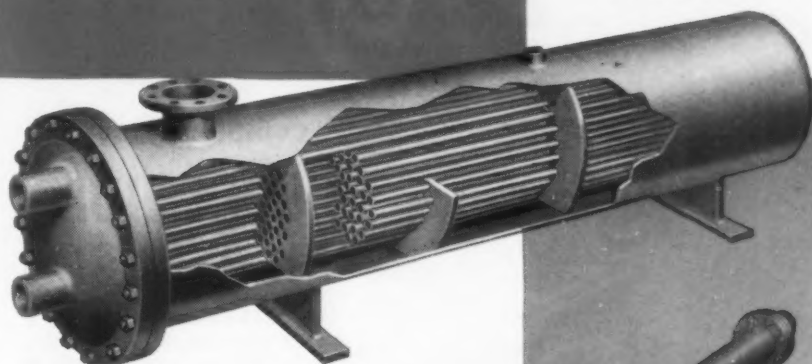
Anodizing Rack

U. S. Patent 2,654,707, Oct. 6, 1953.
D. E. Saffel, assignor to Reynolds
Metals Co.

A plating device for immersing container vessels into an anodizing bath consisting of a frame having a pair of flat parallel spaced-apart vertical metal frame members and a pair of substantially T-shaped inverted apertured end members secured to the tops of said vertical members and further having a pair of spaced-apart rods secured to the ends of the T-shaped end members, a flat longitudinal rack rotatably mounted between the lower ends of the vertical frame members,

HEAT EXCHANGERS

for
CORROSIVE
and
NONCORROSIVE
LIQUIDS
and
GASES



Industrial
**tailored
units**



Whether for laboratory or pilot-plant requirements or large-quantity processing, it will pay you to look into the INDUSTRIAL tailored units for heating or cooling liquids or gases. Rather than adaptations of standard units, INDUSTRIAL heat exchangers are engineered and built to individual performance specifications. Depending on size and other operating conditions, the INDUSTRIAL heat exchanger may be a large single- or multiple-pass tube-bundle type or a series, parallel, or series-parallel combination of individual single- or multiple-tube units. In any type unit, thermal shock and the requirements of the corrosive or noncorrosive fluid on the tube or shell side determines the materials of construction. Thus, each INDUSTRIAL tailored heat exchanger embodies the ultimate in operating performance and efficiency at lower initial and maintenance costs.

Get INDUSTRIAL'S recommendations for your next heat transfer equipment.



This Bulletin describes the INDUSTRIAL service on heat transfer equipment. Ask for Bulletin 600-2.

5009

INDUSTRIAL

FILTER & PUMP MFG. CO.

5906 Ogden Avenue • Chicago 50, Illinois

PRESSURE FILTERS
DEMINEALIZERS
RUBBER LININGS
HEAT EXCHANGERS
CENTRIFUGAL PUMPS

plurality of U-shaped vessel holding brackets disposed in open sided slots positioned at one edge of said rack, a longitudinal lock bar having a plurality of apertures therein for removably securing said U-shaped brackets to said rack, a plurality of locked pegs disposed in said apertures of said lock bar for locking said bar to said rack, a longitudinal float secured to the ends of said rack in spaced relation thereto, and a flat metal coil spring of several turns wound axially about one end of said rack and secured to the flat bottom thereof and secured at the other end to the flat inner face of one of said flat parallel vertical members for conducting an electrical current from said vertical members to said rack, whereby a plurality of container vessels secured to said racks at their vessel bottoms are gradually uniformly filled with anodizing solution upon lowering said vertical spaced-apart members into said anodizing bath.

Chromium Bath

U. S. Patent 2,655,471. Oct. 13, 1953.
A. E. Chester, assignor to Poor & Co.

A chromic acid plating bath for the electrodeposition of chromium containing a trifluoroacetic acid salt of an oxyalkylated fatty amine in sufficient amount to retard the liberation of chromic acid fumes from said bath.

Bright Nickel

U. S. Patent 2,654,703. Oct. 6, 1953.
H. Brown, assignor to The Udyllite Corp.

A bath for electrodepositing fine-grained, bright metal selected from the group consisting of nickel, cobalt, and alloys thereof, comprising an aqueous acid solution of a salt selected from the group consisting of the chloride, sulfate, and fluoroborate salts of the metal to be deposited and mixtures of at least two of said salts, said metal being selected from the group consisting of nickel, cobalt, and mixtures thereof, said solution having dissolved therein an organic sulfinate in an amount falling within a range from about .005 gram per liter of solution to saturation.

Bright Nickel

U. S. Patent 2,654,705. Oct. 6, 1953.
B. C. Case, assignor to Hanson-Van Winkle-Munning Co.

An anode for use in the electrodeposition of nickel consisting of a

**a good pattern
for you to follow**

completely sealed

SELENIUM RECTIFIERS

An analysis of the plants using SEL-REX equipment reveals an eye-opening picture — the majority of the hundreds of SEL-REX equipped plants are world-famous for the quality of their products. These companies represent practically every industry using plating ... decorative and industrial.

Such an outstanding record cannot be ignored. Place your plant in the SEL-REX pattern and enjoy uninterrupted service WITHOUT costly maintenance. SEL-REX ELECTRONICALLY CONTROLLED RECTIFIERS are sealed against dirt, moisture and corrosive fumes. There is a SEL-REX water-cooled or standard air-cooled rectifier for every application.

Literature and names of SEL-REX equipped plants on request. Write to Dept. MF-4



BART-MESSING CORPORATION

229 Main Street

Belleville 9, N. J.

SEL-REX RECTIFIERS for every requirement from 25 to 50,000 amperes.

cathode sheet of electrolytic nickel having the normal columnar grain structure modified by heating to a temperature of from about 2200°F. to slightly less than the melting point of nickel to an equi-axed grain structure with an average grain size not less than about 0.090 millimeter throughout the body thereof.

Buff

U. S. Patent 2,654,978. Oct. 13, 1953.
W. N. Delenk, assignor to The Osborn Mfg. Co.

A rotary buff comprising an annular sheet metal channelform back opening radially outwardly, an elongated retaining element within such channel extending circumferentially within said channelform back, and buffing mate-

rial doubled about said element within such channel with end portions extending generally radially to form the buff face, said material comprising a plurality of felt strips of oblique parallelogram shape arranged in uniform overlapping relationship and doubled about said element with the respective opposite end portions of each said strip offset circumferentially of the buff, thereby forming a peripheral buff face of overlapping strip ends angularly disposed relative to the plane of the buff.

Pickling Aluminum

U. S. Patent 2,655,439. Oct. 13, 1953.
B. W. Floersch, assignor to The Ryan Aeronautical Co.

A process for surface treatment of

aluminum and aluminum alloy material to remove oxides and surface contamination encountered in forming operations, comprising pre-cleaning the material with an alkaline solution, then immersing the material in an etch consisting of 0.1% to 1.0% of chromic acid, 0.5% to 6.0% of sodium fluoroborate and 2.0% to 12.0% of nitric acid, said percentages being by weight and then post-etching the material with a solution of fluosilicic acid.

Electrolytic Detinning

U. S. Patent 2,655,473. Oct. 13, 1953.
F. A. Lowenheim, assignor to Metal & Thermit Corp.

Apparatus for recovering tin from tin plate scrap comprising a vessel for holding bath solution, a rotatable container for scrap submerged in said bath, an insoluble anode in said bath disposed below and separated from the scrap and the container, said anode being insulatedly mounted in said vessel in a substantially horizontal position with respect to said container, a cathode in said bath on that side of the scrap opposite the anode and separated from the anode and from the container and scrap, said scrap being thus positionable intermediate the anode and cathode so as to intercept anodic oxygen generated at the anode and to function as a bipolar electrode, circuit means for connecting the anode and cathode to a source of electric current, and means for rotating the container in the bath.

Scale Removal

U. S. Patent 2,655,481. Oct. 13, 1953.
I. C. Clingan, assignor to Eastern Stainless Steel Corp.

A molten bath for removing oxides from the surface of metals which comprises a fused substantially anhydrous mixture of 90 parts by weight of sodium hydroxide, 10 parts by weight of an alkali metal nitrate, and about .1 to 4 parts by weight of sodium borate and a spectroscopic amount of iron.

Method of Plating Wire

U. S. Patent 2,656,283. Oct. 20, 1953.
A. O. Fink and A. E. Bishop, assignors to The Commonwealth Engineering Company of Ohio.

The method of plating metal wire of continuous length which comprises continuously moving the wire therealong from a source of supply through

a plurality of chambers including a gaseous metal plating chamber, heating said wire as the same is continuously moved along to a temperature sufficient to decompose a heat-decomposable gaseous metal compound brought in contact therewith, said moving hot wire being maintained in a non-oxidizing atmosphere, moving said heated wire into said plating chamber and subjecting the same to a continuously moving gaseous mass at least a portion of which comprises a heat-decomposable gaseous metal compound, said wire being heated to a temperature sufficient to cause decomposition of said heat-decomposable gaseous metal compound which is circulated in contact therewith and deposition of the metal constituent thereof on the surface of the wire as the same is continuously moved therealong, and maintaining a differential in gaseous pressures between said plating chamber and preceding and succeeding chambers, said pressures within the chambers adjacent the plating chamber being slightly higher than that within said plating chamber to prevent leakage of said gaseous metal compound from said plating chamber.

Method of Plating Rolled Sheet Metal

U. S. Patent 2,656,284. Oct. 20, 1953.
H. A. Toulmin, Jr., assignor to The Commonwealth Engineering Company of Ohio.

A process of continuously plating a moving hot metal sheet as delivered from a mill which comprises the steps of guiding said hot metal sheet therealong while heated to a temperature between about 1300 and 1600°F., cooling the same under nonoxidizing atmospheric conditions, said metal sheet being cooled to a temperature which is sufficient to cause decomposition of a heat-decomposable metal vapor compound brought in contact therewith, subjecting said hot moving sheet to a plurality of gaseous metal plating treatments, said gaseous metal plating treatments comprising exposing said moving hot sheet in a plating chamber to a gaseous mass at least a portion of which consists of a heat-decomposable metal vapor compound, said plating chamber having chambers adjacent thereto which are kept under slightly higher gas pressure than in said plating chamber, said sheet being maintained at a temperature sufficient

When Electro-Cleaning..

..get ALL these results!

1. **FAST, EFFECTIVE CLEANING** insured by the ability of the cleaning solution to carry high current densities.
2. **MINIMUM CLEANING COSTS** resulting from long-lived cleaning solutions.
3. **FLEXIBLE OPERATION** from the use of a cleaner that can be employed for either anodic or cathodic cleaning.
4. **DOUBLE-ACTING RESULTS** from a cleaner that works chemically as well as electrolytically.
5. **NO ATTACK ON METALS** by making sure that your cleaner is safe for the metals you process.

Magnus makes a complete line of Electro-Cleaners. You can get ALL these results on your work by using the Magnus material that has demonstrated its superiority on aluminum, soft metals, die cast, steel or combinations of any of these metals.

The Magnus laboratory is always ready to make test runs on your particular metal units to determine which Magnus Electro-Cleaner is best suited to your work.



MAGNUS CHEMICAL CO., INC.

11 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd., Montreal
Service Representatives in Principal Cities

to cause decomposition of said heat-decomposable metal vapor compound and deposition of the metal constituent thereof on said moving hot metal sheet.

Production of Coated Soft Iron and Steel Sheets

U. S. Patent 2,656,285. Oct. 20, 1953.
R. S. Burns and R. L. Solter, assignors to Armco Steel Corp.

A process of softening cold reduced iron or mild steel sheet stock which comprises subjecting said stock to a strand anneal in an elongated furnace with two successive portions separated by baffles, introducing into said furnace in counter-current to the stock passing therethrough a dry, hydrogen-bearing atmosphere, which fills the

final portion of said furnace beyond said baffles, introducing moisture into the initial portion of said furnace ahead of said baffles whereby to bring the hydrogen-bearing atmosphere therein to a dew point of substantially 110° to 170°F., maintaining the said forward portion of said furnace at a temperature between substantially 1300 to 1650°F., maintaining the final portion of said furnace at a temperature above substantially 1700°F., cooling said stock from the temperature of the final portion of said furnace in a hood connected therewith and supplied with said dry hydrogen-bearing atmosphere, and, without re-exposing said stock to the external atmosphere, passing it beneath the surface of a molten coating metal.

Recent Developments

New Methods, Materials and Equipment
for the Metal Finishing Industries

Chemicals in Polyethylene-Lined Drums

*Hanson-Van Winkle-Munning Co.,
Dept. MF, Matawan, N. J.*



Polyethylene-lined drums will be used by the company for shipping all chemicals packaged at the Matawan plant. Replacing wax-lined and unlined fiber containers, the new drums will permit customers to store chemical supplies longer without loss of net weight or damage to either product or container.

The lining, which is inert to all products shipped, will prevent deliquescent products from losing moisture during shipment and storage. It will also prevent moisture from damaging hygroscopic products. The manufacturer is using the new drums principally for packaging powdered chemicals, nickel chloride, cobalt sulphate and brighteners and addition agents used in electroplating baths. There will be no change in the drum sizes available or in the cost of the packaged product. Drum sizes at present range from 10 to 400 pounds.

The new drum consists of a polyethylene bag fitted into a fiber container that has a steel bottom. The bag-liner is permanently sealed to the bottom of the container. The liner tube is made extra-long to allow for envelope-

fold, string tie, tape or heat-seal closure. The extra-length also offers contamination-proof reclosure after the drum is open.

New Product Stops Pickling Fumes

Cowles Chemical Company, Dept. MF, 7016 Euclid Ave., Cleveland, Ohio.

The addition of a new product, AA Compound, to its metal cleaner line is announced by the above firm.

Designed to reduce the hazards and discomforts of pickle rooms, the compound produces a foam blanket on the surface of the acid bath, smothering the fuming, fogging and spraying action which is very damaging to men and equipment. A white, granular powder, it is dust-free and slightly acid. Added directly to the pickle bath in quantities as small as three ounces to each 100 gallons of acid solution, it produces a blanket of foam which is stable and long-lasting. Acid action is not reduced in any way, and faster pickling operations are possible because the foam blanket keeps the heat in the tank, eliminating the loss of heat through fuming. The compound rinses freely and completely and keeps the acid bath clean by precipitating loosened dirt.

Extensive tests have been conducted in the company's Syracuse, N. Y. research & development laboratories and the product has been used in the field in recent months with much success. It is available in 100 lb. and 250 lb. fibre drums. The compound is stocked in warehouses throughout the country.

Liquid Abrasive Blast Machine

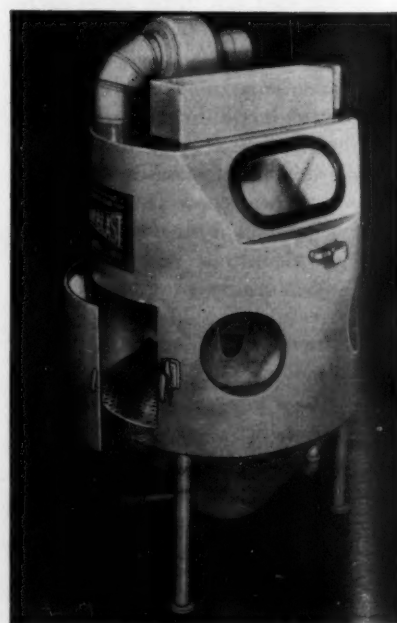
R. W. Benton and Co., Dept. MF, 877 Addison Road, Cleveland 3, Ohio.

A new low cost bench model unit which now puts this up-to-date method of metal cleaning well within the reach of the smallest metal working shop has been announced. Eliminating costly hand operations from metal cleaning routine, it saves up to 60% in labor

costs in cleaning, burring, and etching metals.

The new bench model, while smaller in size than the previous company units, operates with the same high efficiency in speedily and accurately removing rust, scale and all types of foreign deposits from dies, molds, tools and other precision articles without dimensional alterations.

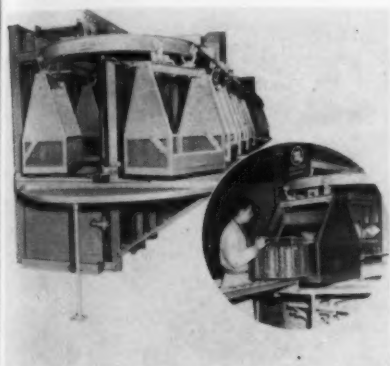
Jet blast is a method of cleaning metals which employs the use of fine abrasive particles suspended in a liquid. The liquid slurry is picked up by siphon injection and propelled to blast proportions by means of a high velocity air stream. There are no moving parts in contact with the abrasive, consequently there are no pumps to wear out. The blast of wet abrasive, when directed upon a surface, imparts a fine cleaning and polishing action. The thoroughly clean matte surface produced by jet blast increases the adherence and bonding qualities of paint, porcelain, rubber, electroplated metals and a host of other materials. It is also effective in cleaning or finishing threads for a close, smooth fit. Variations of abrasives gives the unit universal application.



The compact bench model is 24 inches in diameter, 43 inches high and weighs only 155 pounds. Because of its compactness and relatively light weight, it is portable and can be moved easily from one job location to another. One or two blast guns may be used with 28 to 42 cubic feet of air per minute at a pressure of 85 to 100 psi. Liquid capacity is two gallons and the abrasive capacity is thirteen pounds. The motor for blower operation, the only moving part of the bench model, is $\frac{1}{8}$ hp, 110 volts, sixty cycle single phase.

Automatic Batch Processing Machine

Equipment Division, Magnus Chemical Company, Inc., Dept. MF, Garwood, N. J.

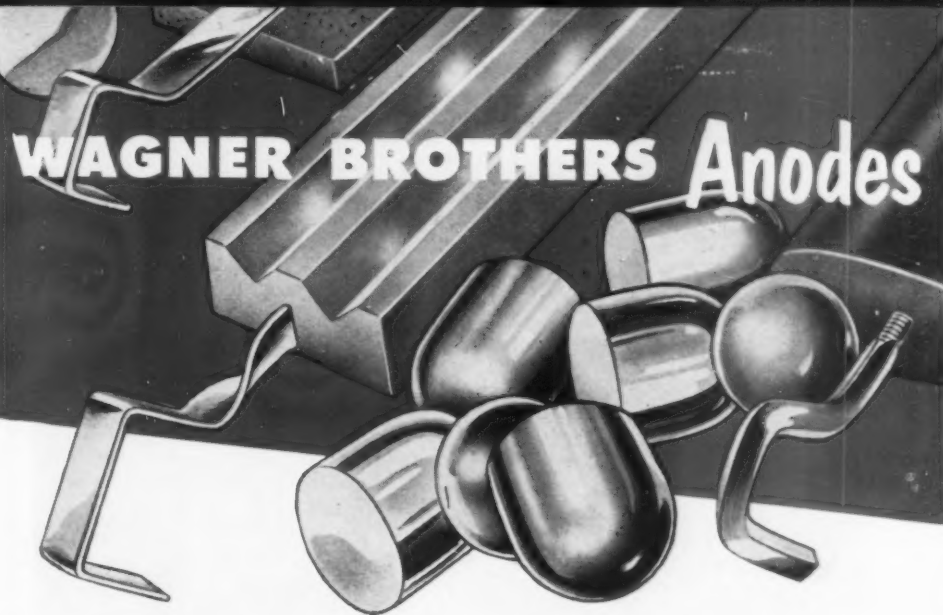


The above firm announces a completely new automation development for the metal working industry, a fully automatic multi-stage batch cleaning and processing method.

This revolutionary equipment, invented and pioneered by the company under the trade name "Aja Lif Automatic," consists of a series of independent, self-contained dipping units serviced by an automatic conveyor system.

The dipping, raising, and transfer of the parts from one stage to the following stages is not only fully automatic but, in addition, the work to be processed is vigorously agitated up and down in each solution according to a pre-determined exposure time program. The entire operation is fully automatic. The whole unit is serviced by only one operator. A timing device makes it possible to vary the processing cycle according to technical requirements. The equipment is air powered, minimizing fire hazards.

This versatile equipment can be designed for any number of stages, alkaline or acid, and also drying operations. It requires no special foundation



FOR BETTER PLATING FINISHES

NICKEL

Iso-Cast Oval form, cast under the strictest controls which guide our entire anode production to afford best grain size for corrosion in nickel plating bath; available in any length.

COPPER

Flat-top, smooth-surfaced, free from dirt, silicon and oxides; greater weight and increased predictability. Iso-Cast Oval, cast from electrolytic copper under rigid controls. Lectrocop, electrolytic slab, various dimensions.

ZINC

Cast by Wagner's exclusive method in the original Flat-Top form to provide a smooth surface free of contamination, easily identifiable because of its distinctive form. Also available in Iso-Cast Ovals.

TIN

Available in any length in our corrugated Iso-Cast form with locked-in steel contact hook, in standard balls and Iso-Cast Ovals. We also produce Tin-Lead (15% tin, 85% lead) and Tin-Zinc (80% tin, 20% zinc), same forms.

CADMIUM

Available in standard ball form.

BRASS

Various commercial alloys of zinc and copper in both Flat-Top and Iso-Cast forms.

Wagner Anodes are available in principal areas. Phone or write today for information.

Wagner Brothers Products: Automatics. Semi-Automatics. Precision Hard Chrome Units. Tanks. Filters. Rectifiers. Anodes. Anode Containers. Tank Linings. Solutions. Supplies.

Your Primary source for plating and polishing equipment and supplies

Wagner

BROTHERS, INC.

418 MIDLAND AVE. • DETROIT 3, MICH.

CHICAGO • ROCHESTER • CLEVELAND • CINCINNATI • ST. LOUIS • INDIANAPOLIS • NEW YORK

SARAN RUBBER LINING RESISTS H₂SO₄ UP TO 70% CONCENTRATION



*Saran Rubber Lined Tanks Resist
Corrosive Actions of Solutions up to 130°F.*

Saran Lined Pipe Company
2415 Burdette Ave., Ferndale, Mich.

Please send me your catalog on Saran
Rubber Tank Lining.

Name _____

Title _____

Company _____

Address _____

City _____

State _____

SR-1130B

Saran rubber's high degree of chemical and abrasive resistance makes it the ideal lining for your sulfuric acid storage tanks. In addition, it also offers economical, long-term service life in such other applications as processing tanks and similar equipment handling corrosive acids, solvents and other chemicals.

Saran rubber application work is fast and conveniently available through experienced, factory-trained tank liners located at many industrial centers. Get in touch with an applicator or contact our nearest sales representative for information on how to add years to the life of your equipment with saran rubber.

RELATED PRODUCTS—Saran rubber molded parts—stoppers, diaphragms, various-sized moldings for valves, instruments, etc.

Saran lined steel pipe—corrosion-resistant pipe that gives long-term operation with minimum maintenance costs.

SARAN LINED PIPE COMPANY

2415 BURDETTE AVENUE, FERNDALE 20, MICHIGAN

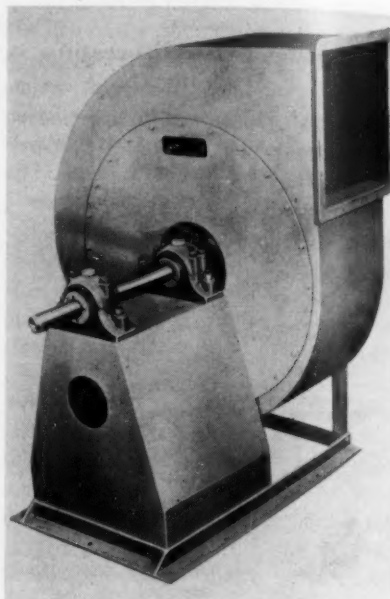
NEW YORK • BOSTON • PITTSBURGH • TULSA • PHILADELPHIA • CHICAGO • PORTLAND • INDIANAPOLIS
SAN FRANCISCO • HOUSTON • DENVER • LOS ANGELES • SEATTLE • CLEVELAND • CHARLESTON, S. C.
MINNEAPOLIS • BETHLEHEM • WASHINGTON • BUFFALO • SPOKANE • ST. LOUIS • PHOENIX
TORONTO • MONTREAL • VANCOUVER • FT. WILLIAM

and can be installed in any existing production line.

These new machines are being used by leading industrial plants for cleaning all types of metal parts ranging from small intricate parts in large batches to large hollow bodies.

Exhaust Blowers for Corrosive Atmospheres

Heil Process Equipment Corp.,
Dept. MF, 12901 Elmwood Ave., Cleveland, Ohio.



Two complete lines of exhaust blowers protected for corrosion and abrasion service have been announced.

A compact, self-contained coated exhaust fan set, designed for services ranging from simple ventilating to handling of moderately corrosive atmospheres, is available in blower capacities from 300 to 7000 cfm. For service with corrosive elements, units are supplied with either baked phenolic, vinyl or tough latex coatings to resist a wide range of chemicals including organic materials.

A complete line of heavy-duty rubber covered blowers for rugged service in severe corrosive or abrasive conditions has been made available in blower capacities from 750 to 54,000 cfm. Units are protected against fumes of sulfuric, hydrofluoric and other rough mineral acids by application of one of several types of high grade rubber including natural and Neoprene, depending on service requirements. Fans, of paddle-type design, are dynamically balanced for smooth operation, and maintain efficient suction at hoods despite varying static losses in the overall system.

The addition of these exhaust blowers gives the company a complete line of ventilating equipment for corrosive atmospheres including the necessary engineering facilities. This corporation regularly produces either lined steel exhaust hoods and ducts, or exhaust hoods and duct systems constructed of Rigidon, glass reinforced plastic, or Rigidin, rigid vinyl type plastic.

Complete engineering data and specifications showing blower sizes, horsepower ratings, etc., can be obtained by writing to the company.

Contact Grinding and Polishing Machine

Curtis Machine Corp., Dept. MF, Jamestown, New York.

Four models of a new contact grinding and polishing machine are among several new machines being made exclusively for the above supplier by an affiliate company in Germany.

The four models; DBA-1, DBA-3 (illustrated, without guards), DBA-3N and DBA-4, are all completely integrated, double end, pedestal type machines for abrasive belt contact grinding and polishing.

All models have approximate 18" belt adjustment permitting use of one size belt with various diameter contact wheels. Either two belts, or a belt and grinding wheel, or buff can be employed. The machines are equipped with positive belt tracking devices and



spring loaded belt tensioning. Dust proof ball bearings are used on all machines. All of the DBA models are also equipped with special type belt attachments that can be easily positioned vertically and swiveled to horizontal. This unique type of mounting permits the backstand extension to swivel 90 degrees with maximum utilization of floor space. The models can be furnished with or without these attachments.

The machines are powered by elec-

Roto-Finish machines equipped with push-button controls and automatic timers, will shut themselves off automatically after being manually started and the timer set for the desired timing cycle. Thus with the automatic timer, machines can be started and timed to maintain a continuous production cycle that eliminates what is often the cause of a serious bottleneck. Ask your secretary to ship us two finished and several unfinished samples, marked for the attention of the Roto-Finish Processing Laboratories.

REMEMBER THAT:

- 1 You buy nothing until you have proof that the Roto-Finish process can save you money.
- 2 Roto-Finish guarantees the same results in your shop as are produced on the samples processed in their laboratories.
- 3 Roto-Finish is the originator of modern precision barrel finishing and because of long experience can eliminate for you the costly trial and error purchase of machines.

Write for the Roto-Finish Catalog



BREAKS THE PRODUCTION BOTTLENECK

in precision finishing

Roto-Finish



COMPANY

3706 MILHAM ROAD, KALAMAZOO, MICH.

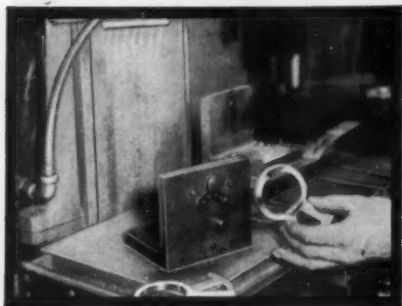
P. O. Box 988 —
Phone 3-5578

FOREIGN REPRESENTATIVES: CANADA — Windsor — Roto-Finish Canada Limited • ENGLAND — London — Roto-Finish Limited — 39 Park Street — Mayfair • AUSTRALIA — Melbourne — A. Flavell Pty. Ltd. • HOLLAND — Delft — N. V. Roto-Finish Maatschappij — Rotterdamse — WEG 370A • AUSTRIA, GERMANY, SWITZERLAND — Frankfurt a.M. — Metallgesellschaft A.G., Germany • ITALY — Milan — Societa Roto-Finish a R.L. — Sesto S. Giovanni — Viale E. Marelli 31 • FRANCE — Paris — Societe Roto-Finish, 70 rue de la Republique-Puteaux (Seine) • BRAZIL — Rio de Janeiro — Commercial E. Industrial de Formas Werco, Ltda.

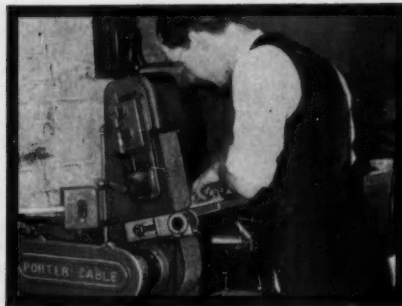
Faster

ON THESE JOBS

...than a lathe
...than hand filing
...than a milling machine
...than a surface grinder



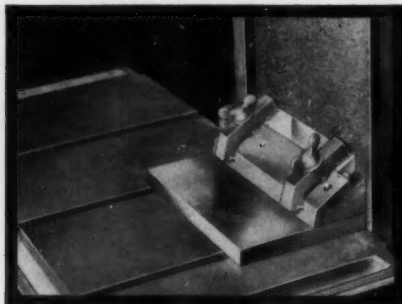
● Facing this thin wall bronze casting formerly took 9 min. on engine lathe—now takes 2 min. on wet-belt grinder.



● Generating radii on forged aluminum gun mount stepped up to 120 pcs. per hr. — double rate of filing.



● Ammunition box rim originally milled for close fitting cap at 33 per hr. — now abrasive belt ground at 89 per hr.



● Angle face on hardened steel cutter bar; output by surface grinder, 4 per hr. — by abrasive belt method, 14 per hr.

Porter-Cable Abrasive Belt Grinders

Now made and sold by Engelberg

How many flat-surfacing, squaring and beveling operations in your shop are performed by millers, lathes and other slow cut-by-cut methods? These single piece operations can be done on abrasive belt grinders in seconds, rather than minutes. More, you often eliminate the need for expensive fixtures—frequently save 75% to 90% of former set-up time.

Find out how Engelberg Abrasive Belt Grinders can reduce your costs. Send sample piece for our recommendations—or ask to have a sales engineer call. To see what others have accomplished, mail coupon for free 32-page case history booklet.

ENGELBERG

● Flexible Belt Grinders ● Platen Grinders ● Contour Grinders ● Bench Grinders ● Centerless Grinders ● Contact Wheel Grinders

THE ENGELBERG HULLER CO., INC.
864 West Fayette St., Syracuse, N. Y.

Please send free booklet showing how abrasive belt grinding performs grinding, surfacing, stock removal operations faster, better, more economically.

Name _____ Title _____
Firm _____
Address _____
City _____ State _____

tric motors with HP varying among the four models. Speed and surface speed of the abrasive belts varies accordingly. This machine, in all of its models, has been designed for top performance and by providing for either vertical or horizontal operation, a minimum of floor space is required.

Barrel Nickel Brightener

Jelco Products, Dept. MF, 153 East 26th St., New York, N. Y.

The manufacturer announces a new barrel nickel brightener for the metal finishing industry. The following claims are made for this material:

1. Single addition agent
2. Does not break down or accumulate
3. Faster, brighter deposits
4. Can be used in both hot and cold solutions
5. Very small additions used
6. Can be used in most pusant solutions
7. Wide operating range.

Complete laboratory facilities are also maintained by the organization for the purpose of serving the industry's metal finishing requirements.

Chromic Acid Spray Reducer

The Udylyte Corp., Dept. MF, Detroit 11, Mich.

A product of the company's research staff, a new surface active agent of a chemically different structure called Zero-Mist completely prevents air and airborne contamination from chromic acid spray and mist.

Dr. Henry Brown, research director and one of the nation's leading authorities on plating, explains the new development as "a control within the solution." It is therefore not dependent for its unusual effectiveness on a heavy foam blanket as is the case with other materials which have been offered for the same purpose.

The product will form only a thin foam blanket even when an excessive quantity is put in the bath, but this blanket is not necessary for the efficient operation of the additive. Completely stable and virtually indestructible, it is not affected by concentrated chromic acid solutions at any temperature or by the highest anode or cathode current densities obtainable. In addition to completely eliminating mist and spray, it also reduces film drag-out up to 50% by virtue of its ability to lower the surface tension of the chromium plating solution to an unusual degree. This makes possible a total saving up to 70% chromic acid.

By eliminating spray and reducing drag-out, the new product drastically reduces rinsing requirements and chrome staining of parts. It also eliminates spray contamination of other baths, duct work cleaning and the necessity for water wash systems and moisture extractors.

Since it is completely stable, Zero-Mist is easy to control and only small weekly maintenance additions are necessary to replace drag-out losses after the initial charge.

Chemical Resisting Cement Mortar

Pennsylvania Salt Mfg. Co., Dept. MF, 1000 Widener Bldg., Philadelphia 7, Pa.

Combining for the first time greater chemical resisting properties, superior physical strength and economy with the stability and non-toxic qualities of ordinary furfuryl alcohol type cements, the Corrosion Engineering Products Department of the company announces a new and exclusive all-purpose product under the trade name of new "Pennsalt Furan Cement."

In its bid for broader markets in the industrial construction and maintenance trades, this new furfural-ketone resin development is highly resistant to acids, alkalis, and most solvents. In addition, tests have established its superior physical strength and longer working life and have proven it to be more economical than conventional alcohol types of furan cements.

The new cement is now available in two formulations. Powder S, a siliceous filler, is resistant to acids, except hydrofluoric, solvents, oils, grease, water, steam and mild alkalis. Powder C is a carbon type filler, an effective resistant for broad acid and alkali protection including hydrofluoric acid. Both powders are easily worked and may be handled safely.

Synthetic Resin Bonding Cement

Ceilcote Co., Dept. MF, 4844 Ridge Rd., Cleveland, Ohio.

The company has announced the availability of Corobond, a new improved synthetic resinous bonding cement for brick and tile. The new material resists the corrosive effects of acids, alkalis and solvents. Chief advantage of the resin cement is its superior workability and longer pot life which provides a greater working time prior to initial set, regardless of



CIRCO
MONORAIL DEGREASER

CIRCO DEGREASERS

Use 30% Less Solvent

CUT LABOR COST
10 TO 50%

Can you afford the high cost of outmoded metal cleaning equipment? The new, modern Circo vapor degreasers—whether large or small—are engineered to save you 30% in solvent consumption and up to 50% in labor costs through more efficient design and operation. Circo, drawing on a background of 30 years experi-

ence in vapor degreasing, builds into its equipment such solvent-saving features as balanced condensing coils, leak-proof pumps, dual vapor-level control and regulated heat input. Circo degreasers are built to perform faster, save precious man-hours, through such construction features as easy access and clearance on two sides, large clean out doors, and well-placed controls and switches.

And ONLY Circo-engineered designs can provide these additional advantages:

1. Immediate interchangeable operation, Trichlorethylene or Perchlorethylene
2. 208 standard designs to choose from
3. Automatic reclaiming of solvent
4. Lowered maintenance costs—ease of cleaning and servicing
5. Complete technical field service—custom-engineered installations

Profit from Circo's firm policy of constant research and study that adapts the latest and best in metal cleaning to YOUR requirements.

And now — Circo Pioneers In Ultrasonic Cleaning

Circo again leads the way with the most modern and talked about metal cleaning development of the century. The new Circosonic Degreaser, equipped with General Electric ultrasonic generator, cleans metal parts by the power of sound—faster than ever thought possible and to a degree of cleanliness that passes the most stringent industrial standards. The Circosonic degreaser may fit your operating needs.

Write for full technical literature.

CIRCO HAS DEVELOPED A COMPREHENSIVE, AUTHORITATIVE MANUAL ON THE SUBJECT OF VAPOR DEGREASING. WRITE TODAY, FOR THIS 32-PAGE BOOKLET. NO OBLIGATION, OF COURSE.

SINCE



1923

EQUIPMENT COMPANY

130 Central Avenue, Clark (Rahway), New Jersey Offices in principal cities

PER-SOLV (Perchlorethylene) CIRCO-SOLV (Trichlorethylene)

Vapor Degreasers • Metal Parts Washers • Dryers • Solvent Recovery Stills

LOOK TO DETREX FOR

Service
WITH A
Saving



SOLVENT
PLUS
SERVICE
EQUALS
SAVING

PERM-A-CLOR

When you use Perm-A-Clor for your degreasing operations, you know why Detrex has become industry's largest direct supplier of trichlorethylene. The reason is very simple—you get more for your money!

To begin with, Perm-A-Clor is premium grade solvent. Through Detrex' modern producing facilities and improved techniques, it costs no more than ordinary solvent.

Just as important are the significant savings you enjoy as a result of the Detrex field service organization . . . largest in the industry. This is an automatic, cost-free benefit for all Perm-A-Clor users.

Specifically, a Detrex field technician visits you to check the quality and efficiency of your degreasing operations. Because Detrex produces both equipment and solvent, our technicians understand the behavior of solvent as well as the design and operation of the equipment in which it is used. These specialists know every factor which influences solvent economy—time cycles, parts drainage, control of air-mix solvent vapors, and complete distillation, to name a few.

Training of operators and supervisors is also a regular function. In short, the Detrex service man becomes a technical advisor on your staff whose watchful eye can save you hundreds of dollars per year without fuss or fanfare . . . an established fact in plants the country over.

To measure the value for yourself, let the nearest Detrex technician prove what he can do to cut your degreasing costs, boost your quality. The coupon below will start the wheels in motion, please use it.

I would like the Detrex Field Technician to point out ways to cut my degreasing costs at no charge to me for the service. Please have him call.

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____



DETREX

CORPORATION

DEPT. S-106, BOX 501, DETROIT 32, MICH.



temperature. A mixture of acid hardeners, acting on a delayed reaction principle, slows the initial hardening and allows ample working time when large batches are mixed. Once started, final cure proceeds rapidly to permit continuous laying-up without extrusion from the bottom courses and to prepare the structure for use within a relatively short time. The cement hardens with minimum shrinkage to an extremely dense material which provides high mechanical and tensile strength.

The new cement, which is designed to eliminate the disagreeable factors ordinarily inherent in resin cements, also assures complete adherence to the building material. It can be spread easily and pressed evenly into a tight joint without excessive pressure. Bricks do not slip or slide, and extruded cement is neatly sliced off leaving surfaces clean.

Optimum workability is obtained when mixed to manufacturer's recommendations. The mixture seldom requires additional liquid or powder because of compensating ingredients which reduce excess liquid absorption. With every batch, masons or plant maintenance men are assured a perfect mix that fills joints easily and completely without running from between bricks.

The ability of the new resin cement to withstand acids, alkalis, solvents, hot water and live steam makes it ideal for the construction of acid pickling and neutralizing tanks, plating room floors, sewers, linings for chemical process tanks and other installations requiring acid or alkali resistance or both.

Peelable Stop-Off Lacquer

Michigan Chrome & Chemical Co.,
Dept. MF, 8615 Grinnell Ave., Detroit
13, Mich.

A new peelable stop-off lacquer

known as Micropeel is announced by the above manufacturer.

The stop-off may be used in all plating cycles to withhold a hairline demarcation. After plating, it may be readily peeled, saving time and money over laborious soak and scrub stripping operations.

It may be brushed, dipped or sprayed. Thorough instructions concerning the proper use of reducer for maximum results are incorporated in a circular which is available from the company for the asking.

Rigid P.V.C. Large Diameter Tubing and Ducting

Kaykor Industries, Inc., Dept. MF, Yardville, N. J.

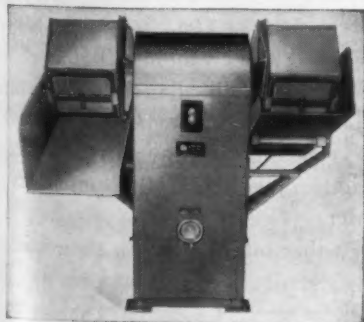
The above firm announces the availability of Vyflex rigid polyvinyl chloride tubing and ducting in 6", 8", 10", and 14" inside diameters. Furnished in 4-foot straight lengths, the pipe and tubing are produced of completely unplasticized and unmodified polyvinyl chloride by a special process which has been perfected by the manufacturer. Several efficient joining methods may be employed to produce multiple pipe-lengths installations.

The extremely high degree of chemical resistance and the excellent physical properties inherent in unplasticized polyvinyl chloride make it an ideal material where severe corrosive conditions prevail and where large diameter sections, such as in waste systems, exhaust ducts, feeder lines, etc. are called for.

New Idea in Tumbling Barrels

Rampe Manufacturing Co., Dept. MF, 3320 St. Clair Ave., Cleveland 14, Ohio.

The manufacturer has designed a twin barrel finisher built around a new idea in handling convenience. It involves the use of moveable chutes under the barrels which can be tilted to



Barrel finishing boosts die maker's production 5000%



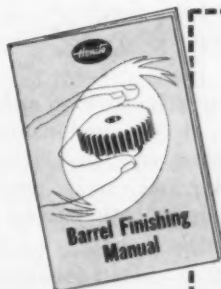
This almost unbelievable production increase was made by Callahan Can Machine Co., Inc., makers of bottle cap dies, when they switched to the HONITE Barrel Finishing Method. Too, per-unit labor costs for finishing were cut by a phenomenal 99.8%!

Dies are used to stamp out painted bottle caps. The problem was to remove sharp edges so that paint on the cap flanks would not be scratched. Former method of hand stoning each die resulted in low production with many rejects because hand stoning did not effectively round off the edges.

A HONITE barrel finishing machine, using SUPER-HONITE chips and the recommended HONITE compound was installed. Production immediately jumped to several hundred pieces per day.

Dies came out perfectly uniform, quality was improved and the reject problem was eliminated completely!

METAL FINISH, INC., Newark, N.J., is the HONITE distributor servicing the Callahan Can Machine Co. Your HONITE distributor can help you increase production and cut costs, too. Call him today!



MINNESOTA MINING & MFG. CO., Dept. MF-44, St. Paul 6, Minn.
I'd like to get more facts about HONITE Service.

- ☐ Send me free copy of "3M Barrel Finishing" Manual
☐ I'd like to talk with a HONITE Sales Engineer

NAME.....TITLE.....

COMPANY.....

ADDRESS.....

CITY.....ZONE.....STATE.....

Type of product to be finished.....

Made in U.S.A. by Minnesota Mining and Mfg. Co., St. Paul 6, Minn.-also makers of "Scotch" Brand Pressure-Sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: 122 E. 42nd St., New York 17, N.Y. In Canada: London, Ont., Can.



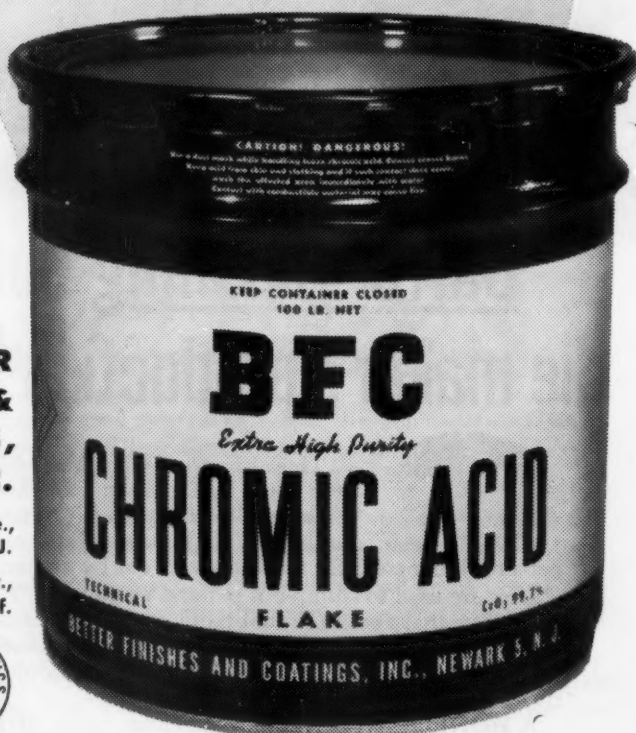
Extra—at no extra cost

We offer product-quality above the industry standard, the interested attention of owner-managers and heads-up local service by as fine a line-up of distributors any manufacturer can have.

If these "extras" appeal to you, we'd like to have a modest order when you're in the market. We are sure you'll appreciate the quality of BFC Chromic Acid and the nice, friendly way we do business.

**BETTER
FINISHES &
COATINGS,
INC.**

268 Doremus Ave.,
Newark 5, N. J.
122 East 7th St.,
Los Angeles 14, Calif.



the rear to drain off liquids, and then can be tilted forward to deliver the load to proper containers.

Another big advantage in this design is the fact that chutes tilted to the rear, while the machine is in operation, form an effective guard around the moving barrels. This is a big improvement over the usual cabinets and covers.

The twin barrels on this finisher have a load capacity of 1.1 cu. ft. each. Barrels are made with the largest possible opening for easier and faster servicing.

The twin barrel finisher is powered with a $\frac{3}{4}$ H.P., 220/440 volt, 3 phase motor. Barrels may be furnished unlined, or lined with vinyl plastic. Write the manufacturer for complete information.

**Room-Temperature Metal
Cleaner**

Klem Chemicals, Inc., Dept. MF,
14401 Lanson, Dearborn, Mich.

A new highly efficient metal surface cleaner that can be used at room temperatures has been developed in the research laboratory of the manufacturer.

The new cleaner is identified as Klem K-A-T cleaner. It is a combination of a special alkaline and an efficacious emulsion cleaner and can be used for removing soil from both ferrous and non-ferrous metals.

The formula is adapted to use in hard water areas without formation of normal hard water precipitates. Maximum corrosion resistance and mini-

mum surface etching are claimed for the product, as well as the fact that the protective film which it imparts to the work piece is compatible with paint solvents, making painting possible immediately after rinse.

Principal advantage of the new cleaner is that it eliminates the need for heat coils in the tank and the cost of heat. For this reason, it is particularly adapted to the smaller shop or department where cleaning is not a regular production process, or where heat might have a physical effect on the part being cleaned.

Textile-Reinforced Disk Wheels

Atlantic Abrasive Corp., Dept. MF,
South Braintree 85, Mass.

The manufacturers announce the addition of Nu-Tex depressed center and straight disk wheels to their line. Designed for weld removal and rough grinding, these new, textile-reinforced wheels may be used on either portable or bench-type grinders. Their special, built-in resiliency provides a cushioned cutting action which reduces bouncing, holds wheel in close contact with work and distributes pressures evenly over grinding surfaces. An extremely tough resinoid bond with textile reinforcement assures extra protection against breakage and increased wheel life.

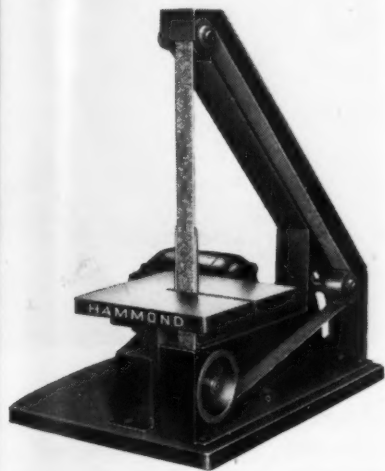


The disk wheels are available in 7" and 9" diameters with thicknesses from $\frac{1}{8}$ " to $\frac{3}{8}$ ". Straight disk wheels are offered in sizes ranging from $\frac{1}{2}$ " or less up to 10" in diameter. Thickness range from $\frac{1}{16}$ " to $\frac{1}{2}$ ". All wheels are available in popular grit sizes. Grades range from 0 (hard) to 6 (soft).

Further information on these wheels may be obtained by writing to the manufacturer at the above address.

1" Flexible Abrasive Belt Grinder-Polisher

Hammond Machinery Builders, Inc.,
Dept. MF, 1600 Douglas Ave., Kal-
amazoo, Mich.



A new abrasive belt grinder-polisher, Model F-1, has been added to the firm's line of abrasive belt machines. This latest machine has the following features:

- A—10½" throat depth permitting the finishing of large, irregular shapes and those hard-to-get-at areas, eliminating hand filing on many jobs.
- B—Work table and belt platen permit accurate grinding of flat surfaces.
- C—Irregular contours can be ground on a "free" belt by removing platen and work table.
- D—Inexpensive, yet built up to standards for production use. Soon pays for itself.
- E—Available as either bench or floor model and with built-in dust collector.

New Deburring Media

The Frederick Gumm Chemical Co. Inc., Dept. MF, 538 Forest St., Kearny, N. J.

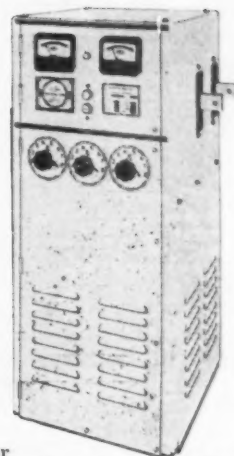
The above firm announces the availability of a new deburring media called Burr-Eens, a natural abrasive which cuts deburring times up to 50%. This abrasive does not fracture during operations, and thereby eliminates the main cause of scratching and gouging. Burr-Eens are available in 9 sizes from 00 (1½"-2") to #10 which corresponds to a 10 mesh.

Further information on Burr-Eens may be obtained by writing to the company at the above address.

DEPENDABLE

**RICHARDSON
ALLEN
RECTIFIERS**

**an unfailing
D-C SUPPLY
for quality plating**



For increased production, improved quality, fewer rejects, lower labor costs—which translates into higher profits—use Richardson-AlLEN dependable rectifiers.

The basic R-A Rectifier is widely used where a single voltage or current is needed or where several rectifiers are to be paralleled.

For electroplating chrome or bright nickel a 22-position tap switch is supplied. For electroplating gold or silver, and for anodizing a 36-position tap switch is used.

A special Heat Exchanger unit is available for use in corrosive atmospheres. This R-A development permits operation at elevated ambient temperatures with a minimum temperature rise. Long, uninterrupted, dependable service is assured.

write for descriptive literature

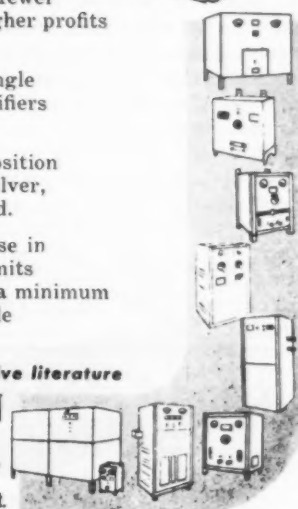
RICHARDSON-ALLEN CORPORATION

a manufacturing affiliate of

WESLEY BLOCK & CO., INC., 39-15 Main St., Flushing, N.Y.

IN CANADA: Richardson-AlLEN of Canada, Ltd., 378 Victoria St., Toronto, Ont.

LEADING POWER CONVERSION SPECIALISTS



BUSINESS ITEMS

Lea Mfg. Co. Appointments

The Lea Mfg. Co. of Waterbury, Conn. announces the recent appointments of John Guss and John A. Doyle as sales and engineering representatives.

Mr. Guss will serve the Midwestern area in a sales and engineering capacity on electrochemical and abrasive finishing problems. He is a graduate of Albright College and Wyomissing Polytechnic Institute. He was chief chemist and metallurgist for four years at Penn-Ohio Steel Corp., Birdsboro,



John Guss

"We tried all makes --- found Nankervis best!"

That's Mr. Jim Taylor speaking. He's supervisor of finishing operations, Black & Decker Manufacturing Company, Towson, Maryland.

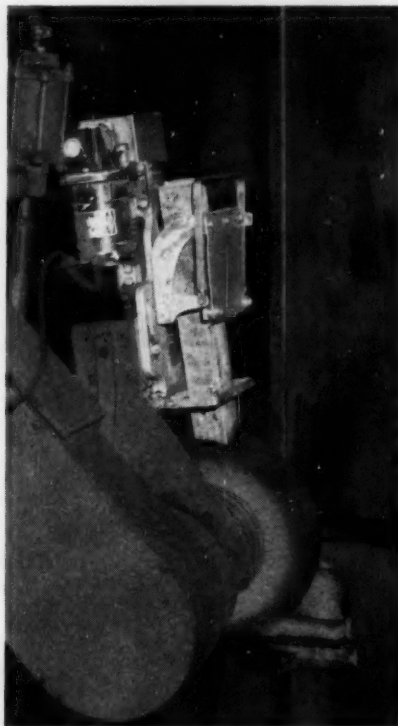
He's referring to a tough problem in automatic buffing recently encountered in his plant. The bugaboo was the many contours and "hard-to-get-around" projections on an aluminum casting for a B & D electric saw. A standard buffing machine had to be altered . . . and Nankervis applicators were given the job of feeding bar compound to specially-constructed buffs

Mr. Taylor says, "We are now using 30 Nankervis applicators on this job. We tried all the different makes available and found Nankervis tops. They apply just the right amount of compound to the buff—they're easy to adjust—and are trouble free."

Results: lower man hours (no wheel tender required), economical use of compound (not too little—not too much); and smoother production flow (fewer rejects). You can save, too; send for Bulletin M-600 today!

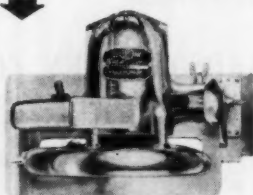
GEORGE L. NANKERVIS COMPANY

19255 W. DAVISON
DETROIT 23, MICH.



(1) Here's a Nankervis applicator at work

(2) Here's the complex casting



Pa. He was also associated with Valley Platers, Inc., Reading, Pa., Division of



John A. Doyle

Wallace R. Ives, Inc. and Birdsboro Armor Cast, Inc., Birdsboro, Pa.

Mr. Doyle will specialize in sales and engineering service to the cutlery and small tool industry on surface finishing problems. A graduate of Catholic University Engineering School, he was associated with Sperry Gyroscope Co., served later with the Naval Forces, Douglas Aircraft Corp., International Silver Co. and G. I. Scott Mfg. Co.

Mr. Doyle will also serve as an engineering consultant on the application of liquid buffing compounds to Clair surface finishing machines.

Chandeysson Names Morse Plant Engineer

Chandeysson Electric Co. has named Ralph Morse, plant engineer. In his new capacity, Mr. Morse will be in



Ralph Morse

charge of all plant utilities, construction and maintenance. He will also supervise maintenance of all plant equipment and will carry out special assignments for the engineering and plant manager.

Formerly supervisor of Chandeysson's testing facilities, Mr. Morse has been with the company four years. Prior to joining the St. Louis firm, he served as an electrical engineer for the Missouri Pacific Railroad. Mr. Morse is a graduate of the University of Missouri's engineering school.

Stalbaum Joins Stokes New York Sales Staff

Ralph H. Stalbaum has joined the sales staff of the New York district office of the F. J. Stokes Machine Co., Philadelphia, Pa., J. C. Coleman, district manager, announced recently.

Mr. Stalbaum was graduated from the University of Nebraska in 1940 with a B.S. in Chemical Engineering. Before joining the organization early this year, he had been a development engineer with Sinclair Refining Co., East Chicago, Ind.; New England district manager for the Duriron Co., Dayton, Ohio; and district manager in Pittsburgh, Pa., for the Byron Jackson Co., Los Angeles.

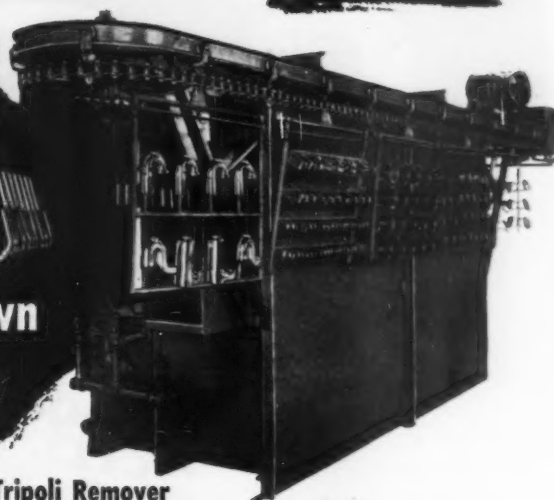
Benner Joins General Ceramics Research Staff

Dr. Paul A. Huppert, manager of the Ceramic Coating Department, Chemical Equipment Division of General Ceramics and Steatite Corp., has announced the appointment to his staff of Stanley G. Benner.

Mr. Benner, former Lt. Commander in the United States Navy, has served

DO A BETTER JOB FASTER...

cut
cleaning
costs
right down
the line



METALWASH Tripoli Remover

cuts costs, speeds production, improves plating quality

The **METALWASH Tripoli Remover** is specifically designed for the removal of polishing compounds from metal parts prior to plating and lacquering.

Loaded racks are conveyed through the tunnel where the *complete removal* of buffing compounds is accomplished *automatically*.

Single-Stage units use an alkali cleaner or a neutral emulsion. Double-Stage machines clean with emulsion followed by an alkali cleaner.

Buffing compound and dirt are kept completely out of the plating equipment. Plating solutions are not contaminated—cleaning of tanks is reduced.

METALWASH Tripoli Removers are designed to fit into existing conveyor lines—the work is handled *on the plating racks*, eliminating all extra handling.

METALWASH VAPOR DEGREASERS provide new speed, economy, durability; better vapor control, coil-free tank walls, dual condensing system, and unitized water separator-pump chamber.

METALWASH SPOTLESS DRYER eliminates hand-wiping of lacquered or plated parts.

METALWASH PHOSPHATIZING MACHINES provide ideal surface for lasting paint finishes.

METALWASH®

WASHING PICKLING DRYING
PHOSPHATIZING DEGREASING

METALWASH MACHINERY CORPORATION
923 North Avenue, Elizabeth 4, N. J.



Stanley C. Benner

in the Bureau of Aeronautics, U. S. Navy Dept. and was a ceramic engineer on the Research Staff of the National Bureau of Standards. He is a graduate of the Pennsylvania State University.

The department produces protective coatings for high and low alloys, aluminum, carbon steel and cast iron.

Enequist Appointed Distributor by Battelle

The **Enequist Chemical Company, Inc.**, 100 Varick Ave., Brooklyn, N. Y., has been appointed a distributor of materials for a new copper-tin plating process. **The Battelle Development Corp.**, Columbus, Ohio, announced recently.

The new readily-controlled process for bronze-alloy plating, known as **Lustralite**, was developed by electrochemical engineers at Battelle Memorial Institute. Laboratory studies, backed up by plant operations, have established several industrial and decorative applications for it.

The bronze-alloy deposit produced by the process is nearly three times as hard as copper plate, yet it is deposited in a ductile condition. Its structure is uniformly fine grained.

There are three compositions for the copper-tin bronze-alloy deposit recommended for different purposes. One composition produces a ductile plate, Knoop hardness 260-280, particularly effective as a bearing overlay.

Another is a slightly harder, gold-yellow plate that buffs easily to a mirror finish and is an excellent undercoat for decorative plating. Chromium can be plated directly on this plate after buffing, or after depositing a very thin bright nickel plate. This composition plus chromium has been superior to an

equal thickness of copper plus chromium in protecting steel against corrosion.

A third composition produces a silvery, very hard (about 400 Knoop) plate unusually resistant to tarnish and scratching. It is excellent for inside automotive and architectural trim, for flatware and reflectors.

Martin Appointed by S. A. Day Mfg. Co.

The **S. A. Day Mfg. Co. Inc.**, manufacturers of buffs, polishing wheels and abrasive compositions and distributors of metal finishing supplies announce the appointment of **J. L. Martin** as vice-president in charge of sales.

Mr. Martin, a native of Buffalo, is a chemical graduate of Canisius College



J. L. Martin



Experienced platers and metal finishers recognize the Mutual label on a drum as their guarantee of uniform quality.

For Decorative Chromium Plating — for Industrial Plating — for Porous Plating of piston rings and cylinder walls — for Anodizing Aluminum — for Dipping after phosphating — and for other metal treatment applications — Mutual's Chromic Acid will produce

consistently good results.

Chromate Conversion Coatings frequently include Ground Chromic Acid. Mutual supplies a grade especially prepared for that purpose.

Buy Mutual Chromic Acid — flake or ground. Prompt shipments from our plants or from distributors' warehouse stocks throughout the United States and Canada.

MUTUAL CHEMICAL CO. OF AMERICA

99 Park Avenue

New York 16, N. Y.

Plants: Baltimore - Jersey City



after which he served three years as a commissioned officer in the United States Navy. He was formerly with *Behr-Manning Corp.* for eight years as a field engineer in the Western New York area.

Robert J. Johnson Joins International Nickel's Pittsburgh Technical Section

Robert J. Johnson, metallurgist, has joined the Pittsburgh Technical Section of *International Nickel Company's* Development and Research Division, according to an announcement by *T. H. Wickenden*, vice-president and manager of the Division.

A graduate in metallurgy of Pennsylvania State University, Mr. Johnson prior to his present appointment was chief metallurgist with the Round

Chain Companies, Cleveland, Ohio. Previously he had been with Republic Steel Corp., Massillon, Ohio, serving in the company's metallurgical research laboratory, and also as plant maintenance metallurgist for two integrated steel plants at Canton and Massillon, Ohio.

Mr. Johnson is a registered professional engineer. He is a member of the American Institute of Mining and Metallurgical Engineers and the American Society for Metals.

Joan T. Wiarda to Attend International Conference on Plating

Mrs. Joan T. Wiarda, vice-president of *Finishing Publications, Inc.*, publishers of *Metal Finishing*, will fly to London on April 17 to attend this



Joan T. Wiarda

year's conference. Following the meeting Mrs. Wiarda plans to visit Holland, Belgium, France, Germany, Italy and Switzerland to see metal working establishments and make a survey of plating and finishing procedures in use. While several American firms have requested that she gather specific information on a number of subjects, she has time to take additional assignments which can be sent care of this publication.

Other Americans who will attend the International Conference include: *J. T. O'Reilly*, Ford Motor Company; *Dr. William Blum*, retired author formerly with National Bureau of Standards; *Dr. Charles Faust*, Battelle Memorial Institute; *M. B. Diggin*, Hanson-Van Winkle-Munning Company; *Dr. R. A. Schaefer*, Cleveland Graphite Bronze Company; *Dr. W. A. Wesley*, International Nickel Company; *Dr. Walter R. Meyer*, Enthone Corporation; *Dr. A. K. Graham*, consultant; *T. C. Coyle*, United Chromium Corporation; *Dr. R. B. Saltonstall*, Udylyte Corporation; and *Walter L. Pinner*, Houdaille-Hershey Corporation.

Home Study Course on Water and Waste Control

The *Joseph B. Kushner Electroplating School* announces a new short home reading course on water and waste control for the plating shop. The course is intended for platers, metal finishing executives, chemists and engineers and covers in crystal clear language every phase of water and waste treatment, taking up in detail methods for minimizing plating wastes and methods for reducing the cost of waste treatment to the lowest possible figure.

The illustrated course, which can be completed at home in three weeks or less, can be taken by anyone with the equivalent of a high school education

or with at least five years of practical metal finishing experience. The school, which is licensed by the Pennsylvania Department of Public Education, awards a certificate to those who successfully complete the examination at the conclusion of the course. For those who do not wish to earn the certificate, the text and appended bibliography will serve as an invaluable reference volume to the subject. Those interested in the course are invited to write to the school at 115 Broad Street, Stroudsburg, Pa., for further details.

Baker & Co. Appoints Chicago Manager

Gordon B. Richdale, president of Baker & Co., Inc., has announced the appointment of Leonard Crane as manager of the Chicago office. For the past fifteen years Mr. Crane has been a sales representative in the midwest for the company, leading refiners and workers of precious metals.

Mr. Crane has been an active member of The American Society of Metals.

Two New District Offices for Frederic B. Stevens, Inc.

Frank Watt, general sales manager Frederic B. Stevens, Inc., Detroit, Mich. has announced the creation of two new district sales offices.

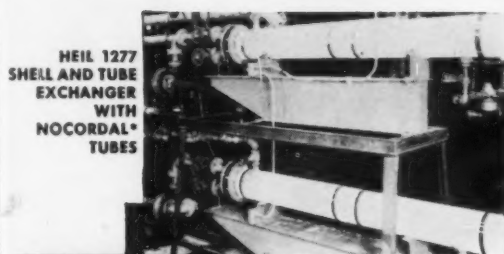
For the company's Foundry Sales Division the company's Indianapolis office and warehouse will be the center of activities for the Central States District. Vince Bruce, Stevens representative in Indiana for several years was appointed to the position of district sales manager. He will supervise foundry supply sales activities in Indiana, Ohio, Kentucky, Tennessee, Illinois and a portion of Iowa.

At the same time, Mr. Watt also announced the creation of a similar sales district for the company's Metal Finishing Division to have headquarters in Dayton, Ohio and warehouse facilities in Springfield, Ohio. Harry Brown was promoted to the position of district sales manager for this area. The territory to be supervised by Brown will be roughly the same as determined for the foundry group.

Portrait of Dr. Chandeysson Unveiled

At a recent meeting of Chandeysson Electric Company distributors, a portrait was unveiled of Dr. Pierre I. Chandeysson, founder and former

HERE'S THE ANSWER TO YOUR ACID HEATING OR COOLING PROBLEM



HEIL 1277
SHELL AND TUBE
EXCHANGER
WITH
NOCORDAL*
TUBES

PUT NOCORDAL*

*Trademark

IMPERVIOUS GRAPHITE
HEATING AND
COOLING UNITS
TO WORK FOR YOU

1. **LONGER SERVICE LIFE** . . . Nocordal is Practically Inert to Most Strong Acid Solutions.
2. **YOU SAVE TIME AND MONEY** . . . Pre-Engineered Standard Units Available in Field Testing Designs.
3. **LOWER OPERATING COST** . . . Superior Heat Transfer Characteristics Coupled with Efficient Design.

STANDARD DESIGNS AVAILABLE FOR

- Shell and Tube
- Immersion Coils
- Electric Units
- Jet Agitators



STEAM
JET
AGITATOR



IMMERSION GRID UNIT

Write Today for Illustrated Bulletin



HEIL PROCESS EQUIPMENT CORPORATION

12901 Elmwood Avenue • Cleveland 11, Ohio

HEIL Products are Sold Through Leading Electroplating Jobbers





Shown above are some of the Chandeysson distributors who attended the meeting.

president of the company bearing his name.

Shown in the photograph on the preceding page are two of the physician-inventor's children, Robert 15 and Carol 16 with James F. Carland, company executive vice-president.

After a brief ceremony commemorating the 50th anniversary of the com-

pany, the photo was placed in the company's reception room.

C. R. Sorber Named Pennsalt District Supervisor

Charles R. Sorber, Jr., has recently been appointed Cincinnati district supervisor for the Metal Processing Department of the *Pennsylvania Salt*

Mfg. Co., it was announced by J. J. Duffy, Jr., manager of this department.

Mr. Sorber who served as sales representative in several territories, will make his headquarters in Cincinnati. He will supervise sales in the Indianapolis-Louisville, Columbus, and St. Louis territories covered by Messrs. A. S. Engle, J. O. Cram, Jr., and F. E. Wilcher.

This experienced team will sell and service the expanded metal processing line of products including cleaners, phosphate coatings and lubricants.

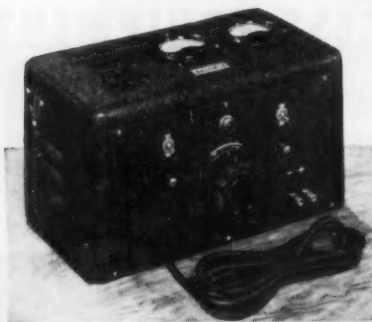
Mr. Sorber, a graduate of Penn State College, joined Pennsalt in 1947 after four years in the Navy. Mr. and Mrs. Sorber and their daughter reside in Cincinnati.

Peterson, Wilson Appointed to New Honeywell Posts

The appointments of C. L. Peterson as divisional vice president of the *Brown Instruments Division* of *Minneapolis-Honeywell Regulator Co.* and O. B. Wilson as general sales manager were announced recently by H. F. Dever, president of the division.

Mr. Peterson, who had been general

for A LOW DC POWER SOURCE



use
the
**KOCOUR
RECTIFIER
MODEL 5B**

A highly refined selenium rectifier with many features . . . powerstat current control . . . choke input filtering with less than 5% ripple . . . Output 0-6/12 volts at 5 amperes, continuous duty ratings.

● KOCOUR testing sets are used all over the world for controlling plating — cleaning — pickling — anodizing — and hardening processes . . . special sets can be provided for your requirements.
Write today for complete information — no cost or obligation.

KOCOUR COMPANY
4801 S. ST. LOUIS AVENUE
CHICAGO 32, ILLINOIS
Specify KOCOUR test sets from your supplier.

For ALL Your Metal Finishing Needs Depend on DAVIES

*The Southwest's Leading Supplier of
Industrial Plating and Polishing*

- COATINGS
- PLATING RACKS
- EQUIPMENT
- CHEMICALS
- ABRASIVES
- ENGINEERING

Davies
Supply & Manufacturing Co.

4160 Meramec St. • MOhawk 4-9332 • ST. LOUIS 16

301 N. Market St. • PROspect 5423 • Dallas 1
5956 S. Kenneth Ave. • PORTsmouth 7-3712 • Chicago 29
813 W. 17th St. • BALtimore 2128 • Kansas City 8

Harshaw Chicago Office to New Quarters



On March 1, the Chicago branch office of *The Harshaw Chemical Co.* moved into its new building located at 4925 S. California Ave.

The modern single story structure with a gross area of 26,000 square feet has been under construction since last October. It houses the sales office, warehouse stocks and a completely equipped laboratory to service the company's new Perglow and Nubrite nickel plating processes recently introduced to the trade.

Located on the Indiana Harbor Belt

Railroad with track, roadway and mechanical handling equipment capable of serving six cars and three trucks at one time, the new facilities provide the space necessary to handle the company's increasing business in the nine North Central States comprising the Chicago District territory.


F. L. Hintze, formerly manager in the Cincinnati District and until recently assistant sales manager at the company's main office in Cleveland, is in charge.

sales manager of the division since July 1952, will devote the major part of his time to sales policy matters and long-range planning. In addition, he will assist Mr. Dever in carrying out managerial duties at the policy-making level. Mr. Wilson, industrial instruments sales manager since January 1953, will assume active administration of the entire divisional sales department.


An engineering graduate of the University of California, Mr. Peterson joined the company in 1927 as sales engineer in the San Francisco office.

In 1945 he was appointed regional manager for the parent company's Pacific region. In 1950 he was named regional manager for the Midwest region in Chicago, a post he held until moving to Philadelphia as general sales manager two years later.

Mr. Wilson joined the company in 1923. He was industrial manager in Chicago, New York and other offices. In 1948 he was made industrial manager for the eastern sales region. In 1952 he was named field sales manager.



WHY RISK



**use UNBREAKABLE
PLAXPAK®
Polyethylene BOTTLES**

LIGHTWEIGHT

CHEMICALLY INERT

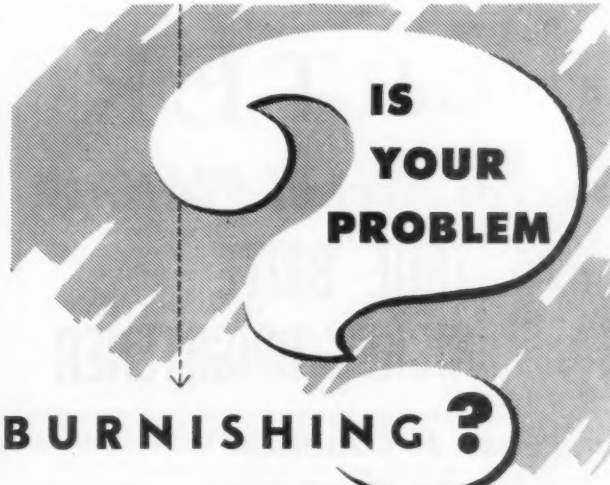
SMOOTH POURING

And handle corrosives with new efficiency, less waste, and greatly improved safety. For more information, write for our folder on Plaxpak Utility Bottles or ask to see a Plax distributor.



PLAX CORPORATION
DEPT. F, WEST HARTFORD, CONNECTICUT
IN CANADA: Plax Canada, Ltd., Montreal & Toronto

IS YOUR PROBLEM



BURNISHING ?



HOLLAND SUGGESTS:

Motor Driven Tilting Tumbling Barrels for cleaning, polishing, grinding, deburring, sanding, burnishing and various other applications.

Write for NEW 1954 Holland Equipment Catalog.

J. HOLLAND & SONS, INC.
276 SOUTH NINTH ST. • BROOKLYN, N. Y.

News from California

By Fred A. Herr



A miniature plating exhibit attracted wide attention at the 1954 Motorama, a spectacle of industrial and engineering progress, held at Pan Pacific Auditorium, Los Angeles, March 5 and 6

under the sponsorship of General Motors Corp. of Detroit, Mich.

With 96,000 square feet of floor space devoted to exhibits, the Los Angeles edition of the 1954 Motorama was claimed to be the biggest in floor area and attendance of its kind staged by GM to afford the public a look at the new cars and how they are made.

The plating exhibit consisted of a miniature full automatic finishing line built to the scale of one inch to the foot. Approximately six feet in overall length, the peewee plating line consisted of some 12 tanks in size from six

inches square to 1½ feet. Copper, nickel and gold solutions were used to plate souvenir medallions which were distributed to show visitors.

Chester Murphy of GM's Detroit research staff was in charge of the exhibit. The miniature plating line consisted of the following sequence of tanks: Cleaner, rinse, copper strike, rinse, acid wash, rinse, nickel, cleaner and gold, plus re-cleaner, degreaser, etc. It was estimated that some 40,000 people viewed the plating show.

The Millhorn Chemical and Supply Co. opened for business March 1 at 6507 Compton Ave., Los Angeles, under the ownership of John Millhorn who, for the past 15 years, served with Mefford Chemical Co. of Los Angeles, most recently as manager of the metal finishing division.

Millhorn reports that he has been appointed selling agent for Federated Metals Division of American Smelting & Refining Co., manufacturers of all types of non-ferrous metal anodes for the plating industry, and will also handle specialized chemicals, equipment, and supplies for metal finishers.

Millhorn has had 30 years experience in the industry. He started in 1924 as a bicycle delivery boy for Denver Fire Clay Co., a Denver, Colo. chemical supply house, and worked up to office manager of the firm's Salt Lake City branch. He joined Mefford in Los Angeles in 1939. He is a member of Los Angeles Branch, American Electroplaters' Society (1953-54 president) and of the Pacific Coast Enamellers Club.

Burndy Engineering Co., 11511 Beltinger Street, Lynwood, Cal., is installing a plating shop to do its own finishing on copper castings for electrical connectors. This plant heretofore has never done its own plating. A 50 x 50 foot section of a recently erected plant addition has been set aside for plating operations.

Installation of equipment for four finishing lines got underway early in March. The setup will have 20 tanks, mainly in a size of 2 x 2 feet, by 3 feet deep. The four lines will consist of: bright dip for copper coating, etching of aluminum, electro-tinning of copper castings, and hot tin dipping, plus rinse and cleaner tanks, and an air de-

BRIGHTER

Barrel Nickel Plating

with TRUE BRITE

NICKEL BRIGHTENER

Increase Production

easy to control . . . cuts down on trouble that entails costly delays.

Save time

can be operated at a higher speed.

Reduce Rejects

gives unbelievable uniformity of deposit in recesses . . . brighter, white color.

Write for FREE bulletin revealing tricks on improving your nickel plating and cutting costs.

TRUE BRITE CHEMICAL PRODUCTS CO.

P. O. Box 31, Oakville, Conn.



GREATER EFFICIENCY
WITH VITREOSIL®
 (pure fused silica)
ELECTRIC IMMERSION
HEATERS
 Available from Stock

Unusually efficient, VITREOSIL electric immersion heaters are the ideal choice for heating acid pickling and electroplating solutions and other acid baths.

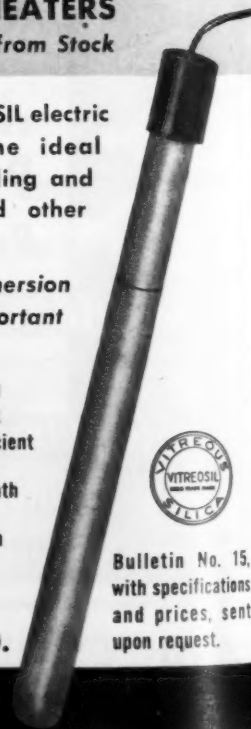
Only the VITREOSIL immersion heater features all these important advantages:

- Increased heat transfer per unit area
- Greater resistance to chemical attack
- Molded rubber cap providing efficient sealing and facilitating installation
- Ground wire inside VITREOSIL sheath for additional protection
- Minimum safe immersion depth marked on each heater

U. S. Patent No. 2,654,820

THE THERMAL SYNDICATE LTD.

14 BIXLEY HEATH
 LYNBROOK, N. Y.



Bulletin No. 15,
 with specifications
 and prices, sent
 upon request.

...burrer, Robert Mellandry of the firm's engineering department, reported to METAL FINISHING, that the steel tanks were fabricated in the company's own machine shop, with acid linings to be installed by outside contractors. Lawrence Lyons is general manager.

Confidence in the growth of the industrial West Coast was again reaffirmed as the Detrex Corporation of Detroit, major manufacturer of industrial cleaning equipment, chemicals, and drycleaning machines, announced the completion of its new branch warehouse and office located in suburban Los Angeles.

Doubling the size of former facilities, the new branch, located at 3027 Fruitland Ave., Vernon, is situated on approximately one acre of ground. The building, of Norman brick trim with Boquet stone pillars, encloses 10,500 square feet of warehouse, drumming plant, and offices.

The new headquarters contains a railroad siding on the property for receiving shipments from Detrex plants in Detroit and Tacoma, Wash., a truck loading dock with modern conveyORIZED materials handling system,



and a unique drumming system utilizing an electric eye for accurate filling of 53-gallon drums of solvent.

The newly constructed branch serves as headquarters for a staff of 8 service and sales engineers serving Pacific region industrial and drycleaning accounts.

In addition to the Los Angeles facility, the company maintains a bulk storage depot of 150,000-gallon capacity for trichlorethylene degreasing solvent at Wilmington, Cal. The chemical, which is manufactured in Tacoma, is

shipped via tanker to the Wilmington depot.

Poly Resins, Inc., formerly at 11356 Tuxford St., Sun Valley, Cal., has moved into a larger plant at 11661 Wicks St., where increased facilities for the manufacture of resins are available, according to President F. C. Bey-er.

With construction completed in March on a new factory at 676 Putnam Drive, Whittier Cal., Union Die Cast-

BEAM-KNODEL CO.

Metropolitan Distributors

HANSON-VAN WINKLE-MUNNING CO.



Complete Service for Metal Finishing

Products Listed Below Available in New York
Stock With Reasonable Exceptions

GENERATORS

Anodes, All Kinds
Brushes
Buffs
Chemicals
Tripoli Comp.
Acme White Finish

Tallow
Rouge
Emery Paste
Cleaners
Emery
Glue

Nickel Salts
Copper Salts
Cyanide
Tanks, All Kinds
Plating Barrels
Polishing Wheels
Polishing Lathes

195 LAFAYETTE ST., COR. BROOME
Phone CAnal 6-3956-7 NEW YORK 12, N. Y.

FILTERS

MAIZO
Drying
Materials

LEA Buffing
& Polishing
PRODUCTS

Never feels the bite... ... Monel

You don't have to worry about the corrosive bite of hot pickling solutions when your equipment is made of Monel®.

Tough Monel is highly resistant to corrosion caused by muriatic and sulphuric pickling solutions.

And it gives you years of trouble-free service. What's more, fabricated Monel equipment can be readily repaired, when necessary, for continued service life.

Check your own plant installations now. You may find many places where Monel can save you money with long life crates, racks, chains and accessories. Inco's Technical Service Section is always glad to help you with your pickling equipment problems. Write, and ask for your free copy of "5 Way Savings...in Pickling."

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.



Monel
PICKLING
EQUIPMENT

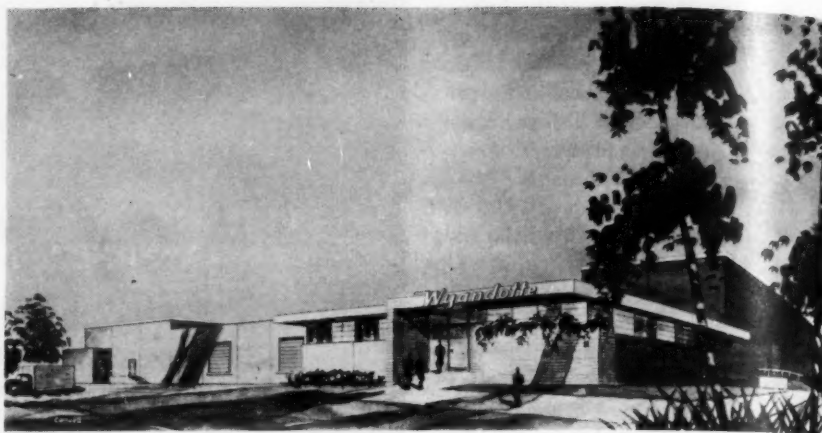
extra life
extra capacity
extra safety



ing Co., Ltd., of Vernon, Cal., was preparing plans for installation in the new building of an automatic plating department, which will make it the only custom die casting plant west of the Mississippi River to have complete die casting and plating facilities under one roof.

The land and 50,000 square foot building represent an investment of \$375,000 without equipment. While complete details of the proposed plating division were unavailable in mid-March, the company reported that approximately 5,000 square feet of floor area will be equipped as a 40 x 120 foot finishing division for plating zinc die castings with copper, nickel and chrome. The facilities will include automatic plating and polishing equipment for finishing zinc castings for the hardware, automotive, aircraft and other industries. The move from the former plant at 2313 East 51st St., Vernon, was expected to be completed by mid-May. *W. H. Boleds* is president and general manager. No plating foreman had as yet been appointed as this report was written.

Wyandotte Chemicals Corp., a major producer of specialized cleaning prod-



ucts for business and industry, in February began construction of a new plant at Los Nietos, *Robert B. Semple*, president, recently announced. The plant site is in Los Angeles County, 16 miles southeast of the city of Los Angeles. *Ford Ballantyne, Jr.*, vice president and general manager of the J. B. Ford Division, said production in the new plant is scheduled for August. At that time manufacturing will be discontinued at the present plant on College Street, Los Angeles, which has been in operation since 1950. The new plant will provide increased product outlet and improved delivery for the

entire Pacific Coast area to the metal industry.

The new plant will occupy a five-acre plot served by the Pacific Electric Division of the Southern Pacific system, as well as being adjacent to major highways. The new buildings will be of the modern functional type and will contain research and technical service laboratories, manufacturing and shipping facilities, as well as the Los Angeles district sales office of the firm.

The new plant will supply materials to more than 170 jobbing firms in California, Nevada and Arizona, as well as



Congratulations TO Chandeysson Electric Co. ON THEIR 50th Anniversary

IT IS A GREAT PRIVILEGE TO REPRESENT ON THE WEST COAST
THIS OUTSTANDING MANUFACTURER OF MOTOR GENERATORS

Check With Us For Your Generator Requirements And For

BUFFING COMPOUNDS

Made in California and Formulated Specifically to Meet Local Needs

PLATING EQUIPMENT & SUPPLIES

GENERATORS • DRAWING COMPOUNDS • POLISHING EQUIPMENT • BUFFS
AUTOMATIC BUFFING EQUIPMENT • PLATING CHEMICALS
METAL CLEANERS • BRIGHT PLATING SOLUTIONS
RECTIFIERS • TUMBLING EQUIPMENT • ANODES

Alert Supply Co.

4755 EAST 49th STREET
LOS ANGELES 58, CALIF.

Phone: LOgan 8-4781

to export agents in Hawaii, Mexico and the Philippines. Representatives of these jobbing firms completely cover bulk users of cleaning, sanitizing and specialized alkalies, as well as floor absorbents in the area served by the manufacturer's new Pacific Coast plant. Production will continue at Wyandotte Chemical's College Street plant until the new unit is completed.

The McBain Corp., Long Beach, Cal., manufacturers of a patented line of valve controls under the trade name of Turk-Master, has been acquired by the Harvill Corp. of Los Angeles, in line with the plans of the latter concern for diversifying its manufacturing activities. R. B. Clevering, Harvill president, announced that Kenneth C. McBain, formerly president and general manager of the McBain Corp., will continue as vice-president and general manager under the revised corporate setup.

The Barksdale Valve Co., formerly at 5125 Alcoa Ave., Vernon, Cal., manufacturers of hydraulic control equipment in the industrial field, has completed the move of its assembly

plant and general offices to a larger building at Fruitland and Alcoa Ave., Vernon.

Pacific Can Co. has construction underway on a 2½ million dollar factory building on a 9½ acre site in Sunnyvale, Cal. Plans call for 200,000 square feet of floor space and facilities for producing 200 million cans a year.

Paul Franke, a plater with the Price-Pfister Co. of Los Angeles, was pleasantly surprised when the management of Rodger Young Cafe, served him with a fragrant dish of sauerbraten and potato pancakes at the March 10 meeting of Los Angeles Branch, A.E.S. Annually, at the meeting which falls closest to his birthday, Paul celebrates by requesting his favorite dish. This year the management beat him to it. When Paul called the maitre d'hotel to give his order, lo and behold, there came a waitress with the steaming dish already prepared.

The Promat Division of Poor & Co., Waukegan, Ill., has announced the appointment of Industrial Materials Co., 383 Brannan St., San Francisco, as Northern California distributor for



Howard J. Lacky, Jr.

their metal finishing processes. Included in the line will be Probrite White Alloy, Promat copper, cadmium and zinc electroplating processes and Promat chromate treatments.

Howard J. Lacky, Jr., owner of Industrial Materials Co., is a graduate of the University of California at Berkeley. The firm's activities cover Central and Northern California, handling supplies and equipment for the metal finishing industry.

**Insure successful, economical,
uninterrupted**

ZINC PLATING

by purifying cyanide zinc plating solutions

with

McKeon's

Zinc-Brite
TRADE MARK REG'D.

No Other Purification Treatment Required.

Simplifies Zinc Plating Procedure.

Substantially Reduces Overall Plating Costs.

WRITE - PHONE - WIRE

Sulphur Products Co. Inc.

228 McKeon Way
Greensburg, Pa.

FILTER 50-1500 GAL/HR ANY ELECTROPLATING SOLUTION

**NO ROUGH DEPOSITS
NO PITTING**

SERVICE: Filters practically any acid or alkaline solution from pH 0 to pH 14; removes particles down to one micron in size. Strainer stops metallic objects.

DESIGN: Filter Assembly fabricated of stainless steel 316, high temperature lucite, rubberlined.

Haveg, or Sethrin® resin. Filter Tubes of cotton, dynel, porous stone, or porous carbon. Pumps fabricated of Hastelloy, stainless 316, or plastic; centrifugal or self-priming. Motors drip-proof, totally enclosed, or explosion-proof, 110 or 220 volt, single or three-phase, 50 or 60 cycle, sleeve or ball bearing. Hose—special acid and alkali resistant. Base—Phenolic laminate on rubber tire ball bearing casters.



Self-Priming
MODEL LSI-10
Cap. 100 gal/hr
H. T. Lucite
Filter Assembly

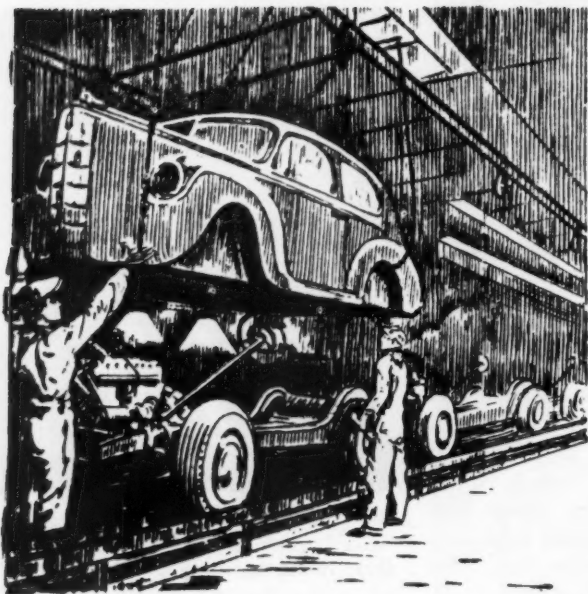
Stainless Pump
Totally Enclosed Motor
Portable—Wt. 60 lbs.
14" x 16" x 16" high

Model	Rated Capacity	Overall Size	Weight
LSI-5	50 gal/hr	11" x 14" x 12"	30 lb.
LSI-10	100 "	12" x 16" x 16"	40 "
ASI-300	300 "	2' x 2' x 2'	125 "
ASI-400	400 "	2' x 2' x 2'	135 "
ASI-600	600 "	2' x 2' x 2'	150 "

*REG. APP. FOR

Sethco

Write for Literature
MFG. 74 Willoughby Street
CO. Brooklyn 1, New York



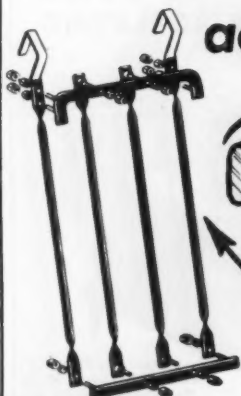
Wagner Brothers Hold Open House

An "Open House" to demonstrate a new hard chrome plating unit will be held by *Wagner Brothers, Inc.*, in Detroit, from April 12 through April 17,

1954. The invitation to attend is offered to anyone with problems associated with the wear and abrasion of parts such as cutting tools, bushings, shafts, and the reclamation of under-size parts.

The actual hard chrome plating process will be demonstrated daily from 4:00 P.M. at 7515 Lyndon, Detroit. Guests are welcomed to submit items for plating. Buffet refreshments will be served. Visitors are requested

Plating Racks you can adjust to the job



Thinker Boy Racks are assembled from precoated members and tips. BELKE Vac-Seal Assembly seals the joints—only contact tips are exposed to the solution. Racks are easily disassembled without damage to coating.

Available as completely assembled racks or precoated rack members and tips.

Send for literature.

Belke

MFG. CO., 947 N. Cicero, Chicago 51, Ill.

EVERYTHING FOR PLATING PLANTS

Effect BIG Saving

When Thinker Boy Racks for a certain job are no longer needed you can respace the members or disassemble and use the parts for other racks.

No added investment. Just order Thinker Boys when you buy racks. Instead of ceilings cluttered with no longer needed racks, you'll soon have a supply of Thinker Boy Parts—be able to assemble coated racks of your own design in a matter of minutes. Ask your BELKE Service Engineer or write for details.

- ★ **BUFFING NU SPRA GLU**
Liquid buffing compound
since 1945
- ★ **NUGLU**
Cold flexible glue
since 1937
- ★ **BRUSHING NUGLU**
Grain and Nuglu mixture
since 1941
- ★ **SPRAY BUFFING EQUIPMENT**
Guns, pumps, and valves
since 1945

J. J. **Siefen** CO.

5643 LAUDERDALE • DETROIT 9, MICH.

to write O. H. Tiedeman, % Wagner Brothers, 400 Midland, Detroit 3, Mich. on business letterhead, stating type of part to be processed.

Frederic B. Stevens, Inc.
Adds Jacoby to Staff



Byron H. Jacoby

It has been announced that *Byron H. Jacoby* has been added to the sales staff of *Frederic B. Stevens, Inc.*, Detroit 16, Mich. This appointment was made in connection with the company's announcement of a new Central States sales district with headquarters in Dayton, Ohio.

Jacoby will cover a portion of the Southwestern Ohio territory. Prior to joining the company he was in sales work and spent three and one half years with the Frigidaire Division of General Motors Corp. He is a U. S. Navy veteran.

Hess Added to Universal-Midwest, Inc. Staff

Universal Midwest, Inc., of Chicago, agents for the *Pennsylvania Salt Mfg. Co.*, have recently announced the addition to their staff of *Walter F. Hess*.

A mechanical engineer, Mr. Hess will handle sales of Pennsalt's line of chemical resistant cements, chemical resistant interliners, and chemical resistant coatings. With headquarters in Detroit, his territory will cover eastern Michigan, western Ohio and Kentucky.

Prior to coming with the company, Mr. Hess was manager of die cast sales for C. H. Hall Lamp Co. in Detroit.

He, his wife and two children make their home in Royal Oak, Michigan.

J. J. Siefen Co. Holds Sales Meeting

At a recent sales meeting of the *J. J. Siefen Company*, manufacturers of



BETTER COMPOUNDS *mean* MORE PRODUCTION *and* INCREASED PROFITS

Thirty years of experience developing and furnishing Polishing and Buffing Compounds to the Automobile Industry and hundreds of allied metal working firms entitles us to solicit the opportunity of working on your polishing and buffing problems.

WRITE US TODAY

C. H. McAleer,
President.

**DETROIT CHEMICAL
SPECIALTIES, Inc.**

101 S. WATERMAN DETROIT 17, MICH.

FOURTH INTERNATIONAL CONFERENCE

ON

ELECTRODEPOSITION and METAL FINISHING

SPONSORED BY

THE INTERNATIONAL COUNCIL FOR
ELECTRODEPOSITION

April 21-24, 1954

HOTEL RUSSELL

LONDON, ENGLAND



Back Row, left to right: A. E. Smith, Indiana; John Johnson, New York State; Robert Tieman, Cincinnati; Harvey Blizzard, Detroit; Cameron Elliott, Cleveland.
Front row, left to right: Eldon Brisson, Central Michigan; Clarence DeGroat, Sales Manager; John F. Siefen, President and Manager; Ralph Hale, Chemist; Alfred Darnell, New England.

liquid compounds, various salesmen of the company were put through a training course to familiarize them with the

new quality control procedure of handling liquid buffing compounds which the company has adapted.

Detroit Branch

President *L. C. Borchert* called the February 5th meeting to order at 8:20 P. M. at the Stanley Hotel with approximately 135 members present.

Secretary *R. J. Racine* announced 37 new applicants for membership and all were voted into the society. A great number of these new members were from Cadillac Motors. This brings the

total membership to 586 for the Detroit Branch. Let's all get behind the good work of Membership Chairman *Joe Gurski* and raise this total to 600.

Guests for the evening were *Gilbert Extale*, General Electric, Ontario, Calif. and *Chuck Forbes*, Rockwell Spring and Axle of Pittsburgh.

Lee Morse announced that the Reed Plating Co. of Detroit is a new sustaining member of the A.E.S.

A list of new officers and delegates were listed, the delegates to be nominated. It was moved and passed that *Herb Head* would also be placed up for nomination as a delegate.

The evening movie "Wings to Hawaii" was presented which depicted the beautiful sights to be seen in the hopeful 49th state.

Education Chairman *Fred Olmstead* presented the speaker of the evening *Dr. Frederick Lowenheim*, Metal and Thermit Corp., whose talk was "Plating of Alloys." Dr. Lowenheim mentioned that tin has always been prominent in alloy plating. Many of the baths used in alloy plating are of the stannate-cyanide type. Tin-lead plating was mentioned as well as tin-zinc plating. The latter was an early substitute for

NEW Barrel Nickel BRIGHTENER

— can be
used
with
present
Barrel
Nickel
plating
solutions

- Faster Plating
- Brighter Finish
- Single Addition Agent
- Hot or Cold Solutions
- Many plus Advantages

Information on request



PRODUCTS

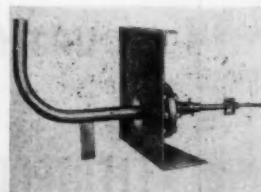
153 East 26th Street, New York 10, N. Y.
LExington 2-3055



ANNOUNCES Three New Developments

*FERROLUM ANODES

1. Permanently Rigid — Excellent
Conductivity — Lighter in Weight
— Long Life — Economical.



2. *FERROLUM GAS HEATER

Low fuel cost, simple to operate, direct fired. Efficient, compact, economical, simple to operate and install. Sturdy, excellent corrosion resistance.



3. LEAD PLATE HEATER

High efficiency, low steam pressure. Large heating surface — Economical and efficient.

*Ferrolum is bonded lead clad steel.

KNAPP MILLS, INCORPORATED
23-15 BORDEN AVE. LONG ISLAND CITY, N. Y.

cadmium, and has excellent solderability after long exposure in storage, which is a marked advantage over cadmium. There are certain requirements for tin-nickel alloy plating in which bagging the anodes and filtration were mentioned. Corrosion tests were reported as being good; however, no specific salt spray hours were mentioned. The British have been more active in tin-nickel alloy plating than ourselves.

The copper and tin-cadmium alloy deposits were also mentioned. In conclusion Dr. Lowenheim mentioned that tin alloy plating is becoming more prominent today. Tin is readily available on the open market, which is an important factor in view of the nickel shortage.

A lively question and answer period followed, particularly concerning the tin-nickel alloy plating. The meeting was adjourned at 10:10 P. M. with fellowship continuing with the serving of beer and pretzels.

John Drinkwater,
Publicity Chairman

O'Hara at Fielden Instrument Division of Robertshaw-Fulton

Robert O'Hara has been added to the staff of the Detroit office of the *Fielden Instrument Division, Robertshaw-Fulton Controls Co.*, as sales engineer. He was formerly on the staff of the Appli-

cation Engineering Department at the Fielden office and factory in Philadelphia.

Fielden, one of eight company divisions from coast to coast, manufactures a variety of electronic recorders and controllers.

Lea Manufacturing Co. Changes Name



Dee F. Mosher, vice president of *Lea-Michigan, Inc.*, Detroit, Mich., announces their new company name,

which formerly was *Lea Mfg. Co.* of Michigan, Inc. *Lea-Michigan*, an affiliate of *The Lea Mfg. Co.* of Water-

BEFORE PRESSURE-BLASTING

AFTER PRESSURE-BLASTING

**Clean prior to plating...
ELIMINATE CHEMICAL CLEANING**

**ONLY PRESSURE BLAST GIVES
YOU 2-SPEED WET-BLASTING**

FREE... Learn what PRESSURE BLAST can do for you! Die and Mold Polishing, Blending Grind Lines, Deburring, Heat Treat Scale Removal, Honing of Cutting Tools, Pre-plating Cleaning... Hundreds of proven, money-saving applications!

Write for our new 8 page fully illustrated Booklet... or send samples of work you want tested to:

MODEL A... ONE OF 4 STANDARD UNITS. CUSTOM MACHINES DESIGNED TO FIT SPECIAL REQUIREMENTS.

**747-5 Windsor Street
Hartford 5, Conn.**

CUTMASTER

**For Long,
Cool Runs
On
Automatic Work**

Let CUTMASTER's perfect balance, and special construction for extra coolness and service slash your automatic buffing costs. We'll rush you the details—write, wire or phone!

WILLIAMSVILLE BUFF DIVISION

The Bullard Clark Company
DANIELSON, CONNECTICUT



Dee F. Mosher

bury, Conn., manufactures polishing wheel cements, liquid buffing compositions and other related surface finishing products and processes for the buffing, polishing and plating industry.

Manufacturers' Literature

Kelvin Bridge Booklet

The Fr derick Gumm Chemical Co.

Inc., Dept. MF, 538 Forest St., Kearny, N. J.

The company announces that the new edition of their Kelvin Bridge Booklet is now available. This gives construction data, diagrams, etc., for building and operating a Kelvin Bridge meter for determining surface resistance values for use in connection with aluminum spot welding, etc.

Rhodium Plating

Baker & Co., Inc., Dept. MF, 113 Astor St., Newark 5, N. J.

This firm has issued a booklet on electroplating with rhodium. Its physical properties are described, as well as its electrical properties, corrosion resistance, thickness specifications and cost. General instructions are given for the metal's applications.

Copies of the booklet are available upon request.

Vapor Degreaser

Ramco Equipment Corp., Dept. MF, 1373 Lafayette Ave., New York 59, N. Y.

The bulletin issued by this firm gives a partial list of 49 articles which can be cleaned by vapor degreasing,

and points out the advantages of using this process. The illustrations show a few of the degreasing machines in use and the type of part each is designed for.

This bulletin, No. 953-1, may be obtained directly from the manufacturer.

Platecoil Applications

Tranter Manufacturing, Inc., Dept. MF, 736 E. Hazel St., Lansing 4, Mich.

A 12 company report on the use of Platecoils in a variety of process heating and cooling applications has just been published in a 20-page brochure No. 154. This bulletin shows how savings can be made in 12 different processing operations through factual reports on the experiences of companies who are making these savings.

In a brief introductory section Platecoils are compared to pipe coils on 10 points. This shows how the former have twice the surface area for a given space and thus a much lower initial cost. It explains how they are installed in a fraction of the time and removed, when necessary, without dumping the solution. It lists 6 major benefits that users have discovered.

BUYERS of any QUANTITY of the following SCRAP

Ni—Anodes
Ni—Peelings ... Strippings ...
Ni—Nodules ... Trees
Cr—Strippings ... Nodules ...
Trees
Ni—Deposited on iron-hooks
... Racks ... Hangers
Tin—Plating Residues
Cadmium—Trees ... Strip-
pings ... Nodules ... Trees
... Residues
Molybdenum—Tungsten
Gold—Silver
Platinum—Scrap ... Residues
... Strippings

Write indicating grade
and quantity available

Distance no barrier

Prompt reply... favorable market prices

Metallurgical

ESTABLISHED 1909

PRODUCTS COMPANY

35th & Moore Sts., Phila. 45, Pa.

3 REASONS FOR TIN PLATING YOUR PRODUCTS

VIA HIGH SPEED Electrotinning



1 USES LESS TIN than HOT DIPPING

Approximately 60% less tin is used in Electro-tinning than in the Hot Dipping method—yet the finish produced is superior.

2 PROCESS IS FASTER, MORE ECONOMICAL

Iron, steel, brass, copper and other metallic surfaces can be coated much more quickly—although equipment needed is simpler, less costly than older plating methods.

3 FULL COVERAGE, PRECISE CONTROL

Ample plating is assured even in deep and odd shaped locations. Deposit thickness and quality can be accurately and easily gaged.

INVESTIGATE NOW

Electrotinning may be the most efficient means of plating to protect and enhance your product. Check and see—M & T will gladly provide technical assistance.

METAL & THERMIT CORPORATION



Chemical Division

100 EAST 42nd STREET, NEW YORK 17, N. Y.

DETINNING • THERMIT WELDING • METALS & ALLOYS • ARC WELDING—Materials and Equipment • CHEMICALS AND ANODES for Electroplating • CERAMIC OPACIFIERS • STABILIZERS for Plastics • TIN, ANTIMONY and ZIRCONIUM CHEMICALS

Barrel Finishing

The Abbott Ball Co., Dept. MF, Railroad Place (Elmwood) Hartford, Conn.

The Abbott Method of barrel finishing and a new, improved tumbling barrel are fully described in a new four-color brochure recently issued by the company. Intended to familiarize tumbling barrel users with a method of barrel finishing which employs the use of steel balls and shapes, the brochure also describes, in detail, the newly revised vertical barrel with base-mounted motor, gear reduction drive and color dynamics finish.

Because it covers all the essential points of de-burring and burnishing stampings, castings and other metal parts with steel balls and shapes, the literature also gives useful information pertaining to these materials. Some barrel finishing materials discussed are deep hardened and tempered for burnishing. Others, used in conjunction with certain abrasives, are called "soft" metal shapes and contribute definite actions to cutting down and de-burring operations. With more and more manufacturers turning to tumbling or barrel finishing to reduce production costs, company has issued

this brochure in order to round out the type of information currently available on this subject.

Copies of this brochure are available by writing to the above address.

OBITUARY

RUSSELL H. PELLINGTON

Russell H. Pellington, president of



Hydro Chemical Co. of Farmington, Conn., died Wednesday, February 24, 1954, at his home in Windsor, Conn., after a long illness. Mr. Pellington had been active in the finishing field since 1925.

Mr. Pellington was born in Paterson, N. J., February 12, 1889, a son of the late William and Mame Borroughs Pellington. He leaves his wife, Mrs. Edith Leslie Pellington, a son, William Pellington, deputy prosecutor of the Wethersfield Town Court, and one grandchild.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

1954 CONVENTION

The committee for the A.E.S. Convention to be held at the Statler Hotel in New York City, July 12-15, has made arrangements to coordinate travel for members and others planning to attend the convention. Irving Gold-

BUY



For the Finest in
**PLATING
RECTIFIERS**

A BETTER SOURCE OF DC POWER — MORE FOR YOUR MONEY

Now Lektron plating rectifiers are available in two types. (1) Lektron Selenium for cool zones, or (2) Lektron Magnesium-Copper Sulphide for the hot, dirty, tough jobs. Heavy duty transformers — husky fan motors — built to last. Built-in voltage regulation — meters — or remote control optional.

Units operate from minus 40° F. to 225° F. at 50 - 50,000 amperes DC. No failures in units working 4 years "round the clock." Investigate "LEKTRON" before you buy — get quality of product backed by a company of integrity at a "price you can afford."

COMPLETE ENGINEERING SERVICE

Illustrated—Model 4045 Plating Power Supply. 750 amperes at 12 volts DC—1500 amperes at 6 volts DC. For use with 208, 220 or 440 volt, 3 phase, 60 cycle, AC. Full wave rectification. Size—20" wide, 26" deep, 56½" high. Weight 525 lbs.

SOME JOBBERS AND SALES TERRITORIES OPEN



ELECTRONIC RECTIFIERS, INC.

2102 SPANN AVENUE

INDIANAPOLIS 3, INDIANA

Do you work with
ACIDS AND CHEMICALS?
NOW SAVE UP TO

80%

on
work clothes cost!

WORKLON

Industrial Apparel of acid
and chemical resistant

DuPont **ORLON**
or Union Carbide
DYNEL

★ ACID, CHEMICAL
AND ABRASION RESISTANT!

★ U.S. NAVY SAYS:
OUTWEARS COTTON 50 TO 1

★ LAUNDERS AND DRIES
QUICKLY — NO IRONING!



*Du Pont Orlon
acrylic fiber

SAVE
MONEY!
SEND FOR
OUR BIG
FREE 1954
CATALOG!

WORKLON, INC. Dept. MF1, 253 West 28th St., New York 1
FREE! Rush WORKLON's new, fully illustrated catalog of
ORLON, DYNEL, and COTTON WORK CLOTHES.

Firm Name _____
Address _____
City _____ State _____
Attention of _____ Dept. _____



Irving Goldwasser

wasser, a member of the committee, has secured the assistance of the Atlantic-Pacific Travel Agency, Inc., 138 East 53rd St., New York, N. Y. to make travel accommodations for those conventioners who make requests. Mr. Jules Cortell, president of the agency, suggested that anyone wishing to take advantage of this offer, which is free of any service charge, should contact him at the above address. Where enough registrations from one city or



Derick Hartshorn, Jr.

territory would make it feasible, a special plane or railroad car could be obtained for conventioners only. The agency will also have facilities at the convention for making return trip accommodations.

The entire committee is rolling along in high gear, especially the educational section headed by Milton Nadel. Milton has delivered many papers before various branches of the A.E.S. and is Librarian of the New York

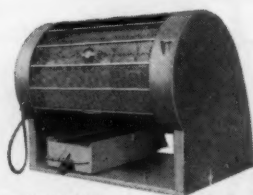


Peter Veit

Branch. This background gives him an excellent idea of the subjects, quality and value of papers to be offered at educational sessions, which are the most important events of any convention sponsored by a technical society. Papers on levelling in copper baths, electropolishing, organic finishing, polishing techniques, electroless plating, waste disposal, water treatment and other topics of interest to the finisher will be presented.

TUMBLE
GRAV-I-FLO
FINISH ...is the complete
and authoritative source
for all tumbling needs!

• **Machines.** 5 sizes—66", 48", 36", 32" and 24". Cam locked doors with safety stop; unlined or rubber lined; constant or variable speed; J.I.C. controls; timers 5 min. to 20 hrs.; electric wiring and water piping.



Model 66"
Two compartments

• **Compounds.** Natural and synthetic deburring and finishing chips and highly developed compounds out-perform every type of tumbling process offered.

• **Accessories.** Separator and chip grader, hoist pans, chip pans, wash-out doors, screens, chip bins, unloading boots, dip tanks.

• **Investigate.** Our representative will visit your plant, or you may send samples direct to us. Engineering Service available to all users.

THE GRAV-I-FLO CORPORATION

Dept. MF4, 400 Norwood Avenue, Sturgis, Michigan

* Handle a variety of tough corrosives without danger of rust or contamination.

Buna N Pumps, Valves and Fittings



VANTON'S new Buna N line resists most inorganic acids, alkalies, salts and fumes, as well as many organic chemicals . . . at temperatures up to 225°F.

Centrifugal pumps with open or closed impellers ranging in capacity from 20-130 gpm, head to 100 feet, suction 2" and discharge 1½".

Globe, angle and Y valves with metal reinforced stems and discs, and readily renewable seating surfaces of soft rubber. Float valves, foot valves, strainers and check valves. Sizes range to 4".

Pipe & fittings—plain or threaded. Tees, ells, couplings, crosses, bushings, flanges, unions, cocks, plugs, and caps. Full flow capacity and high strength. Working pressures of 50 psi.

Bulletin HR-2 tells the full story. Write today for free copy.

VANTON corrosion resistant products for fluid handling include flex-i-liner plastic pumps, polyethylene valves and PVC pipe and fittings. Bulletins on request.



VANTON
PUMP & EQUIPMENT CORP.
EMPIRE STATE BUILDING • NEW YORK 1, N.Y.

The committee has arranged to publish a Convention Journal which is being prepared by Co-Chairmen Derick Hartshorn, Jr. and Peter L. Veit. This journal will be distributed at the convention and will contain the Official Program, a very interesting technical article, a list of New York Branch members, and advertisements of manufacturers and suppliers of equipment and supplies for the finishing industry. Proceeds from the Journal will be used to help defray the cost of one of the functions planned for the convention. The Co-Chairmen wish to announce that there is still time for those wishing to insert an advertisement, but urge them to do so at an early date, as the closing is fast approaching.

Los Angeles Branch

Thirty-nine new members were acquired by Los Angeles Branch of the American Electroplaters' Society during a concentrated membership drive which began last September and ended March 10.

Reporting at the March 10 meeting at Rodger Young Auditorium, *Stuart Krentel*, president-elect, who as last

year's first vice-president spark-plugged the drive, announced that *Larry O'Neil* of the *L'Hommedieu & Sons Co.* emerged as first prize winner (a \$50 merchandise certificate) by virtue of having signed up twelve new members. *Tony Stabille* won second prize, a \$25 certificate, for having brought in seven new members. This brought the branch's total to around 240, highest it has ever been.

Twelve new members were inducted at the March 10 meeting in a rousing windup of the drive. These included *H. W. Smith, Ronald Hubbard, Joseph Beddenberg, D. W. Shine, R. W. Dickson, W. C. Cahill, John Ruzzatti, A. C. Israel, James A. Stewart, D. C. Moore, Fred Weiss* and *A. R. Wiseman*. Applications were received from *Lester Daniels, Charles Hanson, Fred Illune, Roy L. Osborne, Antonio S. Rojas* and *Harry S. Duke*.

Jack Bealle, William Horrigan and *Earl Arnold* were elected delegates to the A.E.S. national convention, with *John Muzzotti, Don Bedwell* and *Fred Weiss* as alternates.

Secretary *L. Truman Stoner* read a letter from New York Branch requesting that a local member be appointed

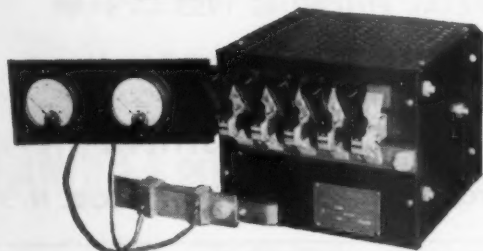
to serve as session chairman at one of the open forums to be held at the July convention in New York. *Earl Arnold* of the *L. H. Butcher Co.* was named to represent the branch in that capacity.

Also read was a letter from *Marcus Rynkofs*, a charter member of the branch, expressing his thanks for the flowers sent during his recent illness. Mr. Rynkofs was reported to be convalescing at home from the heart attack which hospitalized him in January, but is still unable to return to active direction of his Liberty Plating Co.

The speaker at the educational session was *E. G. Schroeder* of the Electric Products Co., Cleveland, O. In introducing the speaker, Librarian *George Magueran* described Mr. Schroeder as an electrical engineering graduate of Rensselaer Polytechnic Institute who had spent nine years with General Electric Co. prior to his present nine year tenure with Electric Products. For more than five years he served as manager of the Detroit office, living daily with the electroplating activity of the automotive industries in the Michigan areas, which represents the greatest concentration of decorative plating in the United States.

FOR THE RIGHT CURRENT DENSITY

USE COLUMBIA TANK RHEOSTATS



It's easy to adjust your tank voltage to suit the load with a Cast Grid Type Columbia Tank Rheostat. Standard sizes from 15 to 5000 Amperes, 1 to 6 Volt drop. Other voltage drops as specified.

COMPARE THESE OUTSTANDING FEATURES:

- Cast Grid Resistors, rugged and resistant to chemical fumes.
- Cam Operated Toggle Switches, quick break, self-cleaning, positive contact, readily accessible, easily operated.
- Rugged construction and liberal design provide ample capacity for intermittent and momentary overloads.
- Entire rheostat, including instruments, easy to install.

WRITE FOR BULLETIN MF-500

COLUMBIA ELECTRIC MFG. CO.

4529 HAMILTON AVE.

CLEVELAND 14, OHIO

Also Manufacturers of Motor Generator Sets,
Reversing Switches, Tong Test Ammeters



Plain Tanks by STORTS

- Precision Welded

STORTSWELDED tanks in all categories are noted (1) for their dimensional accuracy and (2) for the finely executed, uniform welding that develops the full strength of the plate metal. When you need tanks made to order, let Storts do it.

STORTS
WELDING COMPANY
INCORPORATED

Manufacturers of Welded Fabrications to Specification

38 Stone Street
MERIDEN, CONN.

Mr. Schroeder spoke on "Application, Use and Maintenance of Rectifiers and Motor Generator Sets for all Electrolytic processes." His discussion dealt chiefly with power equipment in general and motor generators in particular as they affect the profit picture of a plating shop.

The speaker declared that an attitude still prevails among platers to regard power equipment merely as something which stands over in a corner of a plant and is of no vital importance.

He declared that power equipment is the key to production and the governor of profits. The plating industry is cyclic in character, he pointed out. One week the shop may be partially idle, and the next week roaring with activity as the result of a new work contract. Proper and adequate power equipment, he emphasized, is a "must" for platers operating in a competitive market, for the difference of a few hundred dollars a month in the power bill may be the difference between profit or loss.

Cincinnati Branch

President C. Truman called the meet-

ing to order at 7:45 P.M. with forty-three members and guests present. Roy Critchfield reported on the interim meeting in Toronto. His report included data on the financial condition of the National Society; and also information on how to obtain and retain members for the branches. Mr. Critchfield also reported that he announced the intention of the Cincinnati Branch to get the National Convention for 1958 or as soon as possible thereafter. He suggested that Cincinnati form an active committee to advertise and promote the 1958 Convention for Cincinnati.

Ezra Blount in reporting on the interim meeting in Toronto gave the following methods used by some of the other Branches to increase their attendance:

- (1) Place names of those present in a bowl and draw a name for a \$5.00 prize.
- (2) Exhibit Society publications at the meetings to remind members and visitors of the work being done by the Society.
- (3) Increase the number of Branch workers.

- (4) Arrange special programs in conjunction with some of the meetings; for example, a Past Presidents' Night.

Wil Loveless announced that 140 reservations have been made for the Tri-State Meeting, and that \$550.00 in donations have been received. He also mentioned that the Tri-State Meeting is to be announced in the Metal Finishing, Products Finishing and Plating Magazines.

The business session was adjourned and the panel talks were started by President Truman's introduction of the first speaker, Lester Helmich who spoke on, "Chromium Plating on Steel and Aluminum Aircraft Parts and Chromium Plating for Tool Salvage." Mr. Helmich devoted most of his talk to hard chromium plating on aluminum, but mentioned the value of hard chromium in salvaging tools and gages.

Jno. Magly spoke on, "Gold Plating on Electropolished Steel and Silver Plating Copper Powder." To point out the unusual problems that arise in the plating room, Mr. Magly discussed silver plating copper powder, and decorative chromium plating directly on electropolished stainless steel.



Job-fitted to cut your costs



Edmont
JOB-FITTED
GLOVES

Case No. 207: Handling sharp-edged metal products in hot plating solution . . . Job-fitted gloves reduced hand injuries 78%. Saved 6c per man-hour on cost of glove replacements. Edmont's laboratories have developed and test-rated 34 types of coated work gloves to fit different job conditions. Send brief description of your operation. We will recommend and furnish test samples of the correct glove and name of nearby industrial supplier.

Edmont Manufacturing Company
1276 Walnut Street, Coshocton, Ohio
Largest maker of coated fabric gloves

BOUND VOLUMES

METAL FINISHING 1951 — \$7.00

METAL FINISHING 1953 — \$9.00

Book Orders Payable in Advance

METAL FINISHING

381 BROADWAY

WESTWOOD, N. J.

PERIODIC-REVERSE UNITS

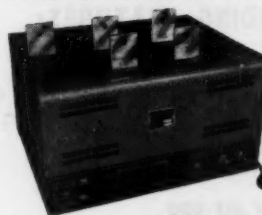
Of the Finest

Quality for

PLATING

In the Modern Way

Write for Information



UNIT PROCESS ASSEMBLIES, Inc.

75 East 4th St.

New York 3, N. Y.

Ed Roof spoke on the subject of, "Zinc Barrel Plating-Cycle Plating in Lucite Barrels." He discussed loading of the plating barrels, cleaning cycle for use with Lucite barrels, the cooling of the plating solutions, and other phases of barrel line operations such as rinsing, pickling and post-treatment dips. Mr. Roof showed colored movies to illustrate his talk.

Wm. B. Stephenson, Jr. chose for his subject, "Automatic Anodizing, Production and Experimental Plating. Besides discussing automatic anodizing in detail, Mr. Stephenson mentioned copper plating for heat treat stop-off, silver plating, and electroless nickel.

After the talks the panel of speakers answered questions from the floor. The talks and subsequent discussion period proved to be interesting and informative.

The meeting was adjourned at 9:30 P.M. and the Social Hour following the meeting was sponsored by Herbert Chem. Co. and Pennsylvania Salt Mfg. Co.

William Young,
Secretary

Rockford Branch

The regular monthly dinner meeting of the Rockford Branch was held Monday evening at 7:00 P.M. in the Winnebago Room of the Faust Hotel.

Thirty-four members and guests enjoyed a very fine meal. For the business meeting which followed; fifty-two were in attendance at which time nominations and the election of officers took place. Elected to office for 1954 and 1955 were as follows:

Vern Wissen, Oakite Products, president.

LeRoy Johnson, Atwood Vacuum Machine Co., 1st vice-president.

Robert Johnson, Lawrence Brothers, 2nd vice-president.

Ellsworth Budden, Rockford Clutch Div., sec'y-treasurer.

Lawrence Ray, Barber-Coleman, librarian.

A report was given on the annual educational session and banquet to be held April 3rd and everything seemed to be proceeding very nicely. The committee in charge of this affair assured all who attend a very good time would be had at either function.

Gerry Lux of Oakite Products who, incidentally, is very well known to many members of the Rockford Branch, was introduced as the speaker of the evening. His topic was, "Cleaning as pertained to Organic Finishing." Mr. Lux who is very well qualified to speak on this subject, gave an exceptionally fine paper which was thoroughly enjoyed by all to the fullest extent. A very lively discussion period followed with a great many of those present taking part. The Rockford Branch is sincerely grateful for being given the opportunity of having Mr. Lux at the March meeting.

The meeting adjourned at 10:15 P.M.

E. J. Budden,
Sec'y-Treasurer

Chicago Branch

The technical meeting on February 12, 1954 was preceded, as usual, by a cocktail mixer, the branch business meeting and dinner. After dinner about forty members of the Chicago Branch gathered in the auditorium of the Western Society of Engineers to hear an interesting presentation by Joseph Pokorny, service manager for the G. S.

THE MASTERS ELECTRO-PLATING ASSOCIATION, INC.

59 EAST FOURTH STREET, NEW YORK 3, N. Y.

Is Proud to Announce Its

36th Annual BANQUET and ENTERTAINMENT

to be held

Saturday, May 8, 1954

in the

Starlight Roof of the Waldorf Astoria
New York City

Cocktails 6:30 P.M.

Banquet 8:30 P.M.

Subscriptions \$25.00 per Person

DON'T BE FOOLED BY FALSE CLAIMS



FINE BUFFING COMPOUNDS
ARE A COMBINATION OF
THE BEST OF MATERIALS
AND YEARS OF MANUFACTURING
EXPERIENCE

ROBERTS ROUGE C O M P A N Y

STRATFORD, CONN.

Originators of Micro-Lustre Finishers

Since 1881

(A LONG TIME TO
CONTINUE SUCCESSFULLY)

Blakeslee Company on the subject "Vapor Degreasers vs. Power Washers."

According to Mr. Pokorny power washing, a process essentially involving the spraying of alkaline type cleaners at high velocities on the work to be cleaned, can do some jobs that a vapor degreaser cannot handle. Conversely, the vapor degreaser can handle some jobs that the power washers cannot do. However, either method can be satisfactorily used for most jobs.

The stimulating and lively discussion period which followed the talk by Mr. Pokorny was indicative of the members' interest in the subject.

A warm welcome was extended to three new Branch members. They are: *Richard Hemmingway, F. Allen Palmer and John Pavlowski*. A cordial welcome was also extended to the General American Transportation Co., who have just joined the Society as a sustaining member.

Jerome Kuderna

New York Branch

The meeting was called to order by *Al Fusco*, first vice-president, on February 12, 1954 at the Hotel Statler. The minutes of the previous meeting were

read and approved. The roll of officers was called and noted absent were Messrs. Amatore, Nadel, Schore and Maher. The absence of the first three being due to their attending the A.E.S. Interim Meeting at Toronto.

There being no other business, the meeting was turned over to *P. Veit*, who, in turn, presented *Mr. VanderPool* of the Metalizing Eng. Co. Inc., VanderPool included the presentation of a colored film with his speech, showing the latest techniques in "Metalizing" which was most interesting.

Lester Levinson

Recording Secretary

Buffalo Branch

Jack Winters, Technical Director of R. O. Hull & Co., Inc. of Rocky River, Ohio gave an illustrated lecture before the Buffalo Branch meeting on February 5, 1954, on the subject "Tuning up for Plating."

He noted that the present tendency in all industry today and most particularly in plating is the tendency to get by and adapt job to include the problem instead of correcting the problem.

In plating there are several fundamental problems. First the plater must

take the part with the surface condition as received and must change that to one which is usable to apply the metal deposit. Second the electrochemical effects in the plating bath itself.

The most common problems were, in Mr. Winters' opinion, as follows:

1. Overpreparation of surface in cleaning.

2. Attack of metal by acid leaves smut of precipitated carbon on steel. As an illustration he suggested using 3 cup shaped cathodes made of steel, copper and carbon and noticing the difference in throwing ability in the recess on the three cathodes. As a means of preventing smut he recommended using either an inhibited acid or an alkaline derusting compound.

3. In the electrical system, check anode contacts as in most tanks there are quite a few anodes that are not operating. Uniform current distribution is important to good plated deposits.

4. Bipolar effect of unlined steel tanks. The effect on long parts of being nearer to the bottom of the tank than to the anodes. He recommended using glass or rubber panels on the sides and ends of tanks and brick on the bottom.

"IT'S THE FINISH THAT COUNTS" NEW HOME OF UNITED LABORATORIES COMPANY



Our New Plant & Equipment enables us to manufacture Tailored Compounds to your specific needs.



**GREASELESS COMPOUND
TRIPOLI BAR & LIQUID
STAINLESS STEEL LIQUID
NU-GLO LIME FINISH
CHROME ROUGE
RED ROUGE — GREEN ROUGE
EMERY PASTE
WHITE ROUGES
ALUMINUM OXIDE PASTE**

Truly—Three Great Finishes!! CHROMIUM - UDYLTE SHERARDIZING

For over a quarter of a century building and installing portable sherardizing furnaces and equipment: metal finishing and plating.

We invite your inquiry.

THE NATIONAL SHERARDIZING & MACHINE CO.

OFFICE & FACTORY: HARTFORD, CONN.

Foreign Representatives—
Oliver Bros., Inc., 417 Canal St., N. Y. City

SOMMERS BROS. MFG. CO. MFRS. OF "BEACON"

Plating and Polishing Supplies and Equipment—
Complete Semi and Full Automatic Installations—Gold, Silver and Chrome Rouge, Stainless Steel and Satin Finish Compounds—Buff, Polishing and Felt Wheels.

**3439 NO. BROADWAY
ST. LOUIS 7, MO.**

WANTED

Progressive plating organizations and individuals who want better plating results. Apply by letter to **Joseph B. Kushner, Electroplating School, Stroudsburg 3M, Pa.**, without obligation, for information on how you can improve quality, reduce waste and increase efficiency in the plating room with **ELECTROPLATING KNOW HOW**, the unique home study course in modern electroplating. A wonderful opportunity for the right men!

5. Chemical analysis of baths. Recommended that baths be analyzed at frequent intervals by empirical methods and check analyses once a month.

6. Never adjust a bath without an analysis first — do not fiddle with baths.

He then showed colored slides of the effect of addition agents to plating baths when plated in a "Hull" cell.

Eric G. Sampson, Jr.,
Secretary

Milwaukee Branch

The Milwaukee Branch Annual Educational Meeting and Banquet is to be held Saturday April 24, 1954 at the Schroeder Hotel.

Reflecting the trend of the times the program will have as its theme, "Metal Finishing in Today's Competitive Market." Papers will be presented by the following:

Arthur M. Linn, United Chromium Inc., "Bright Nickel Plating in Today's Competitive Market."

C. O. Hutchinson, Sales Manager, Nubian Industrial Division of The Glidden Co., "Organic Finishing for Today's Competitive Market."

Ken Huston, Rustless Division

Armco Steel Co., "Stainless Steel in Today's Competitive Market."

Louis J. Minbiolo Jr., Assistant Sales Manager, Udylyte Corp., "Plating in Today's Competitive Market."

This year the program will start at 10:00 A. M. and continue to 11:30 A. M. Lunch from 11:30 to 1:30 and afternoon session from 1:30 to 3:30. The evening banquet and entertainment will start at 7:00 P. M. as usual.

Vincent Mattacotti,
Publicity Chairman

Jackson-Lansing Branch

The Jackson-Lansing Branch held their regular February meeting at the Hotel Porter, Lansing, Mich., February 9th, the occasion being the third annual Ladies Nite. An excellent group attended, and participated in very satisfying prime ribs of beef dinner with the following entertainment of dinner music by stringed trio, accordionist, group folk dancers, magic, and choral group singers.

The entertainers, while being of amateur standing, would rate well on a professional standing. All being very well received. Gifts for both ladies and men put a pleasing finishing touch for the evening. Our sincere thanks and

appreciation for the many individuals and firms for the support provided.

R. W. Redmond,
Publicity

Hartford Branch

The regular branch meeting of the Hartford Branch was held at the Bond Hotel on Feb. 15th and about 85 members and guests were present. Preceding the meeting a movie in color entitled "The Story of Research" was shown through the courtesy of the Du Pont Co.

The guest speaker for the evening was *William F. Cahill* of the William F. Cahill Co., Providence, R. I., whose subject was "Electroless Nickel Plating."

Mr. Cahill described the composition of the bath which is based on the pioneering work of Dr. Brenner, and others, of the National Bureau of Standards. This bath now in use consists of Nickel chloride, Sodium Hypophosphite and a complexing agent sodium glycollate. Various tests were described where the amine type and other hydroxy acids (lactic, citric, malic, etc.) complexing agents were tried with unfavorable results. Nickel



**SOMETHING HAS
BEEN ADDED**

At no extra cost you can have approximate temperature control as well as removal of condensate from steam coils or jackets, by using...

SARCO THERMOTONS

in place of ordinary steam traps. They are of the liquid expansion type and can be set to discharge condensate at any desired temperature below 212°F.

Some condensate is thus held back, moderating the heating effect of the coil to maintain the temperature required.

Ideal for cleaning or rinsing tanks. Not affected by corrosive fluids as the unit can be entirely outside the tank.

Write for Bulletin 552.

KARYALL METAL BASKETS

for every industrial requirement

- PICKLING
- PLATING
- HEAT TREATING
- QUENCHING
- DEGREASING
- HANDLING

of any type metal

- STEEL
- STAINLESS STEEL
- MONEL METAL
- BRASS
- COPPER
- INCONEL
- ALUMINUM

Perforated Metal • Expanded Metal • Wire • Solid Sheet

WHATEVER YOUR NEED — WE CAN MAKE IT FOR YOU
MAIL TODAY FOR ILLUSTRATED BROCHURE



NAME _____
ADDRESS _____
CITY _____ STATE _____
METAL BASKET DIVISION
KARYALL BODY, INC. 8221 CLINTON RD. • CLEVELAND 9, OHIO

SARCO SARCO COMPANY, INC.
SAVES STEAM Empire State Bldg., New York 1, N.Y.
SARCO CANADA, LTD. TORONTO 2, ONTARIO



OR COMPLETE FINISHING EQUIPMENT & SUPPLIES

Full Automatics, Rectifiers, Tanks, Rheostats, Generators, Filters, Plating Barrels, Cleaners, Dryers, Degreasers, Plating Chemicals, Solutions, Anodes, Bright Nickel, Bright Dips, Stop Offs.

POLISHING EQUIPMENT & SUPPLIES

Lathes — Compositions —
Buffs — Polishing Wheels —
Abrasives — Tumble Finishing
— Pressure Blasting.

W. M. FOTHERINGHAM

Send for products file for
Complete plating & polishing equipment
& supplies

975-81 Niagara St., Buffalo 13, N. Y.

HAMILTON MILLS



For color and lustre beyond compare, specify **INDIAN BRAND TURKISH EMERY**. Preferred by those who know the best.

Also available — **HECCO BRAND AMERICAN EMERY**, for use in abrasive pastes and compositions.

HAMILTON EMERY & CORUNDUM CO.
CHESTER, MASS.



ACID
RESISTANT

Electric
Immersion
Heaters

for
Metal Pickling
and
Plating Solutions

Totally inert to all acids
at any concentration
except hydrofluoric.

Sizes: 1000 to 10,000 watts

DEALERS WANTED

Please send FREE descriptive bulletin #15-D

Name _____

Title _____

Company _____

Street _____

City _____ State _____

PYROSIL, Inc., Cuyahoga Falls, O.

may be plated out at 0.0008" per hour at a temperature of 190° F. to 195° F. in a uniform deposit especially in places of poor metal distribution such as in the bores of tubing. The nickel metal content and the pH are controlled carefully and porcelain or cobalt glass lined tanks are used.

The technical chairman for the evening was *Walter Acker*.

Stanley Platoz,
Secretary

Waterbury Branch

The regular monthly meeting of the Waterbury Branch was held on February 11, 1954 in the Colonial Room of the Hotel Elton. After the dinner preceding the meeting, President *Frank Eddy* opened the meeting and announced the death of *Bob Leather*, pioneer of the branch. A motion was made and seconded that the branch donate \$25.00 to the Heart Fund in his memory, rather than send the conventional flowers.

President Eddy turned the meeting over to the Technical Chairman, *Bill Innes*, who called on *Dr. George Dubpernell* to give the book review. *Dr. Dubpernell* reviewed three books on Waste Treatment Control, and passed them around to the membership for their inspection.

After showing the usual movie entitled "Telephone Pioneering," Mr. Innes turned the meeting over to the chairman of the nominating committee, *Dr. Dubpernell*, who presented the following slate for the 1954-55 year:

President, *Perry J. Sloane*.

First Vice-President, *Joseph V. Petrocelli*.

Second Vice-President, *Fred S. Foster*.

Secretary, *Spencer L. Henn*.

Assistant Secretary, *Arthur W. Tracy*.

Librarian, *Theodore Voyda*.

Assistant Librarian, *Edward J. Garland*.

Publicity Director, *William P. Innes*.

The speaker for the evening, *Tom Fadgen*, Laboratory Director, General Motors Corp., Ternstedt Division, Trenton, N. J., spoke on "Plating Waste Treatment by Ion Exchange." Mr. Fadgen discussed the installation of such a system in their plant, highlighting the many variables to be carefully considered, and the various unseen problems involved. The main point of the talk was the value of making one gallon of water do the work of three gallons. Water conservation is a problem, which presents a challenge to industry, Mr. Fadgen pointed out, and must be practiced because of the large increase in water usage for irrigation and air conditioning.

After a brief question and answer period, the meeting was closed by giving Mr. Fadgen a rising vote of thanks.

CHICAGO ELECTROPLATERS INSTITUTE

The *Chicago Electro-Platers Institute* has elected *Charles N. Jensen*, president, *Jensen Plating Work*, as chairman to succeed *Lawrence J. Hay*, *Plating Service Co.* Also elected were *Robert*

MANUFACTURERS OF ALL PURPOSE

CLEANRITE

METAL CLEANERS AND BURNISHING COMPOUNDS

HAY CHROME SALTS—Increases Chrome Throwing Power

GLO DIP—For Bright Dipping Copper, Brass and Bronze

SPECIALISTS IN THE ENGINEERING OF ELECTRICAL IMMERSION TYPE
TANK HEATERS.

Call on us for the answer to your difficult problems.

Distributor for the Best in

PLATING AND POLISHING EQUIPMENT AND SUPPLIES

COMPLETE PLATING PLANTS ENGINEERED

SERVICING THE FINISHING INDUSTRY — 1935 - 1953

JACOB HAY COMPANY

Centralized Manufacturers and Distributors
4014 WEST PARKER AVE. CHICAGO 39, ILL.

TEL. CAPITOL 7-8800

L. Giesel, president, Adolph Plating, Inc., who succeeds Jensen as vice-chair-

man, and John Lietz, B. Mercil & Sons Plating Co., succeeding Giesel as secretary-treasurer.

Elected to the board of directors for two year terms were retiring Chairman Hay; C. J. Kennedy, American Buffing & Processing Co.; Harold W. Baker, Electro Galvanizing Co.; and Fred Wahlen, Mechanical Plating Co.

The Chicago Electro-Platers Institute is an association of 101 job-shop plating plants in the Chicago area.

THE GALVANIZERS COMMITTEE

The Galvanizers Committee, which is sponsored by the American Zinc Institute, will hold its thirty-first meeting in St. Louis, Mo., on April 20-21, 1954, according to Chairman J. S. Alter, of United States Steel Corp.

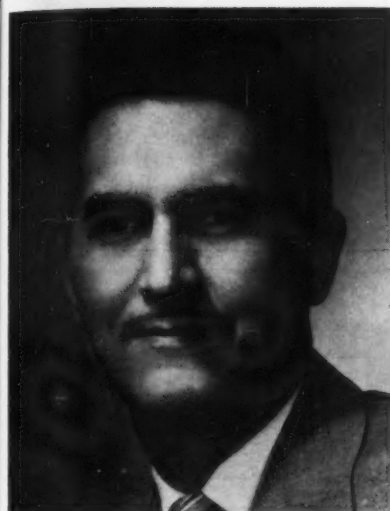
E. F. Lundeen, asst. supt. of quality control, Inland Steel Co., heads the program subcommittee for the occasion, which will be held at the Hotel Statler concurrently with the annual meeting of the American Zinc Institute previously announced.

ASTM Committee B-8 on Electrodeposited Metallic Coatings

Although some years ago the committee agreed not to undertake work on specifications for plating salts and plating anodes, the present membership has reversed this previous stand and task groups have been set up to investigate the practicability of de-



Charles N. Jensen



Robert L. Giesel

BUFFS FOR INSIDE POLISHING



GOBLET BUFFS, TAPER BUFFS, CYLINDER BUFFS, SMALL POLISHING WHEELS, RAZOR EDGE BUFFS, and many others for deburring, polishing and grinding any internal contour.

Write for additional information or contact your local dealer. These buffs are stocked by many dealers throughout the country.

We manufacture a COMPLETE LINE OF BUFFS including full disc loose and sewed buffs and polishing wheels. Our metal center BIAS TYPE BUFF may help cut your polishing costs.

A post card will bring our complete catalog by return mail.

BARKER BROTHERS INC.

ESTABLISHED 1911

1660 Summerfield Street

Brooklyn 27, N. Y.

On any steel blackening problem

DEPEND on DU-LITE for a Superior Finish

Here's an example...



Courtesy The Poly Choke Co.

Du-Lite gave this part with its complicated knurls, slots, threads, etc. a fine rust-resistant durable black finish. It is typical of many other parts, small and large, which have been black oxidized by Du-Lite for many years. Moreover, Du-Lite meets most individual and government specifications including 57-0-2C for Type III Black Oxide finish.

Typical Du-Lite installation



Du-Lite installations are simple, compact, easy to operate. Du-Lite equipment can be tailored to fit production requirements on all types of jobs with a maximum of speed and economy. Du-Lite also makes a complete line of cleaners, strippers, wetting agents, passivating agents, rust preventatives, burnishing compounds etc. for any metal finishing application.

See your nearest Du-Lite Field Engineer or write for more information.

DU-LITE CHEMICAL CORP.
MIDDLETOWN, CONN.

Rush information on your metal finishing products.

Name.....
Company.....
Address.....
City..... Zone..... State.....

Du-Lite

METAL FINISHING SPECIALISTS

veloping specifications for this particular phase of electroplating work. Committee B-8 has also set up a task group to investigate the desirability of specifications for plated coatings presently not covered. These would include such materials as gold, silver, rhodium, etc. Committee B-8 held meetings from February 3 to 5 inclusive, during ASTM Committee Week in Washington, D. C.

Revisions in B 242, Recommended Practice for the Preparation of High-Carbon Steel for Electroplating are currently being balloted upon by the committee. These revisions provide for the inclusion of electrolytic polishing among the Final Pretreatment Procedures.

A recent survey has indicated that there is no interest in supplemental treatments for electroplated lead coatings and consequently this section of Subcommittee V has been discharged.

The study of tin and tin alloy coatings, excluding electrolytic tin plate, will resolve a number of questions as to the performance of these coatings. Present work contemplates an immediate study of tin, tin-lead, and tin-

zinc coatings. Future work will cover tin-copper, tin-nickel, and tin-cadmium coatings. The problems to be considered in connection with all of these materials are corrosion resistance, solderability, and susceptibility to phase transformation. Among the uses are electronics, refrigerators, air conditioners, wire, pistons, and food, dairy, and beverage industries using containers other than "cans."

Officers of Committee B-8:

Chairman: *C. H. Sample*, The International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.

Secretary: *R. B. Saltonstall*, The Udylyte Corp., 1651 E. Grand Blvd., Detroit 11, Mich.

AMERICAN SOCIETY FOR QUALITY CONTROL

The Eighth Annual Convention for the *American Society for Quality Control* will be held in St. Louis, Mo., on June 9, 10, 11, 1954. Headquarters for this convention will be the Jefferson Hotel. The Technical Sessions will be held at Kiel Auditorium.

The program will consist of 72 Sessions, which will include 67 Technical

Sessions and 5 Sessions devoted to Plant Tours. The Chemical and Textile Divisions are participating as are the Aircraft, Automotive, Electronics, Metals, and Operations Research Committees. In addition, the more recently organized Business Operation Committee has a program, and a series will be presented by the Basic Research Committee.

There will be space for the largest number of exhibitors in the history of the Convention and most of it will be filled. There will be a Book Booth in the form of a spacious lounge with plenty of easy chairs. Books on all phases of quality control and many related subjects will be on sale. Several authors are scheduled to be on hand.

Many social events are planned for the evenings, and for those who plan to bring their wives, a ladies' program has been arranged.

Registration blanks and further information may be obtained from:

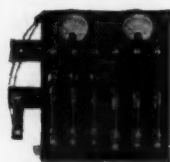
8th Annual A.S.Q.C. Convention
U. C. Gramsch, Registrar
P. O. Box 4436, Wade Station
St. Louis 15, Missouri

CHECK THESE VALUES:

3 VOLT DROP, VOLT & AMMETER RHEOSTATS

100 AMPERES \$49.22

500 AMPERES \$96.65



PLACO RHEOSTATS
1-7 VOLT DROP

Extra heavy copper switches mounted on asbestos panels (Front & Rear) engineered nichrome resistance coils for maximum amperage at minimum heat loss. Volt, Ammeter and Shunt, complete with mounting legs. 50 to 2000 amperes.

METAL FINISHING MFG. CORP.

89 NORTH 11TH STREET

BROOKLYN 11, N. Y.

SELL IT

THRU WAGNERS

Phone, wire
or write
JOE WAGNER
Wagner Bros., Inc.
Midland at Ross
Detroit 3, Mich.

WE WANT new products to sell. We want new ideas to develop for the national metal finishing market. Our active sales force is your assurance of volume. Our successful launching of new products such as anodes, automatics, filters, and rectifiers has given us the experienced background to market your line. Our technical staff will develop or service your product, our manufacturing facilities will produce it, and our sales organization will distribute it nationwide with profit and protection for you.

CORROSION-PROOF

**LININGS
CEMENTS
BRICK**



- TANKS, FLOORS, FUME DUCTS AND PROCESS EQUIPMENT
- COMPLETE LINE OF PROTECTIVE COATINGS...

Over a Quarter Century of Experience



CORROSION-PROOF
MATERIALS • CONSTRUCTION • SUPERVISION

The CEILCOTE Co. 4844 RIDGE RD.
CLEVELAND 9, OHIO

Headquarters for



**BARREL FINISHING,
COMPOUNDS**



40 DIFFERENT COMPOUNDS—making it possible to choose a compound that can give superior results on a given job.

ALMCO Supersheen

AMERICA'S LARGEST MANUFACTURER OF ADVANCED BARREL FINISHING EQUIPMENT—MATERIALS AND COMPOUNDS
ALBERT LEA, MINNESOTA

WRITE FOR
FREE
CATALOG

THE ELECTROCHEMICAL SOCIETY, INC.

The Electrochemical Society will hold its 105th meeting at the LaSalle Hotel, Chicago, from May 2 to 6, 1954.

Sessions are scheduled on: Electric Insulation; Electronics — Instrumentation, Luminescence, Phosphor Screen Application, Rare Metals, and Semiconductors; Electrothermics; Industrial Electrolytics; and Theoretical Electrochemistry. The program includes 145 papers for the four days of technical sessions.

March 3rd Meeting

The meeting of the Metropolitan Section at the Hotel Earle in New York on March 3 was quite well attended, despite the inclemency of the weather. The members were well repaid with an excellent talk by Robert J. McKay, president of the Society, on the subject of corrosion cells.

Mr. McKay reviewed some constructive researches in aeration cells, going back 100 years and describing the development since then and the ups and downs in applying qualitative

and quantitative knowledge of these cells over the years. The speaker included some unpublished results which show parallelism with the galvanic test of W. A. Wesley.

NEW BOOK

Jahrbuch der Oberflächentechnik (Metal Surface Processing and Treatment Yearbook)

Edited by Dr. Phil. W. Wiederholt. Published by Metall Verlag G. m. b. H., Berlin-Grünwald, Hubertusallee 18; 10th Edition, 1954. Price: 5.40 DM. 800 pages.

The "Jahrbuch der Oberflächen-technik" (formerly Jahrbuch der Galvanotechnik) has been prepared with the object of presenting the mechanical surface treatment of metals with consideration of the most recent available information in Germany and abroad.

In the first section of this book a general review is given by A. Schwartz regarding surface treatment techniques

in the German and foreign press; after dealing with fundamental research, the various treatment processes as well as test processes are discussed (hardness, brightness, roughness and thickness measurements, electron microscopy, local determination of cracks, other defects, etc.) Then follows a section by H. Baur dealing with new patents in the field of plating as well as notes on patented processes by E. Zills. The spray polishing process is described by W. Buckart, polishing wheels and polishing equipment by B. Kleinschmidt and mechanical lapping and polishing by H. Finkelburg.

In a further section dealing with electropolishing by J. Heyes the phenomena occurring at the boundary surface electrolyte-metal are discussed in detail. The polishing of plastics and of aluminum is covered in a description of various processes.

The further following sections can also be mentioned: methods and apparatus for surface investigation, plating with periodic reverse current, metal alloy plating, treatment of zinc and zinc alloys, developments in metallization spray techniques, structure of hot

ROLLED NICKEL ANODES

In Stock — For Prompt Shipment
All Sizes

SABIN METAL CORP.

310 MESEROLE AVE. BROOKLYN 6, N. Y.

Telephone: EVergreen 1-5000

HARRISON & COMPANY, INC.

since



1923

SPECIALISTS
IN

BUFFING COMPOUNDS — CEMENTS

Cake - Bar
Spray - Dip

for
Rolls - Wheels -
Belts

BOX 457

HAVERHILL, MASSACHUSETTS

DIXRIP fine wire SCRATCH BRUSHES

SINCE 1896



For PLATERS, SILVERSMITHS, JEWELRY MFGRS., makers of Watches, Clocks and Electronics and other metal finishers. Supplied in straight or crimped brass, steel, nickel silver or stainless steel wire in sizes .0025 - .006 and in bristle, fibre or Nylon. Special sizes and shapes to order.

Write (Dep't. M) on your letterhead for catalog and price list.

DIXON & RIPPEL, INC.

KINGSTON, N. Y.

SPECIAL-New Direct Current Panel Boards



STOP GUESSING—Know what's going on at each plating tank — still or barrel.

Two (2) meters — one DC Ammeter and one DC Voltmeter — 3 1/2" face, mounted on 1/2" thick black Transite, 6" x 10", for wall mounting.

All DC Voltmeters 0/15V range. All DC Ammeters, except 50 amp. size, have separate shunts and calibrated leads. (50 ampere size has internal shunt.)

PRICES

50 amps.	\$20.00
100 amps.	23.75
200 amps.	24.00
300 amps.	24.50
500 amps.	25.50
750 amps.	34.00

Prices on larger sizes on application.

M. E. BAKER COMPANY

25 WHEELER ST.,

Kirkland 7-5460

CAMBRIDGE 38, MASS.

dip zinc coatings and electrochemical thickness measurement.

A detailed survey with numerous formulas and operating conditions for plating is given by *R. Abend* together with processes for electropolishing. Plating of plastics is dealt with by *R. Springer* and *A. Hoch* discusses testing with the Hull cell. In the section on non-destructive testing of coatings and thickness measurement of non-metallic and metallic coatings, the various coating combinations are considered by *O. Werner* in a further interesting section.

The numerous Tables assembled in the appropriate section contain an assembly of all the most important electrochemical, physical and technical data as well as formulas, and makes the Yearbook a work of reference of particular value. The very low price of the book stands in no relation to its quality or value to the technical reader.

**Park
No. 290**

**BLACKENING
SALT**

Black Oxide finishing for rust resistance and decorative parts. Speedy black coating in water solution with no electric current. Permanent black finish on ordnance parts, tools, aircraft, bearing races. Dazzling black decorative finish for television cameras, business machines, hardware, metal screens and machine parts. Excellent bond for paints and enamels. Simple one bath operation. Write for bulletin H-16. Park Chemical Co. 8075 Military Ave., Detroit 4, Mich.

LETTER TO THE EDITOR

Dear Mr. Hall:

We are reluctant to enter into a polemic with an author who is not in a position to defend his thesis, but we believe that the article, 'Some Observations on the Electrodeposition of Tin-Zinc Alloys', by the late Bernard C. Lewsey in your March issue, may leave the reader with some misapprehensions, and we feel therefore that we shall have to take the risk of being unporting.

Mr. Lewsey's article leaves the impression that the tin-zinc process, while in general satisfactory, is extremely critical in control and altogether touchy in operation. Several years' experience on a pilot plant scale plus the further experience of helping to set up and to service many full-scale installations in the plants of customers, lead us to the opposite conclusion; namely, that the tin-zinc plating process is hardly more exacting than the least troublesome processes in the plant and probably a good deal less exacting than such every-day operations as bright nickel plating.

For example, we have found that it has not been necessary to use any but plain steel tanks; the build-up of ferrocyanide, if it does occur, is of no consequence.

The author's remarks on the filming of the anodes reflect the fact that he was using a higher caustic content than that originally recommended. While this is perfectly legitimate, it also accounts for the fact that higher anode current densities have to be used. In any stannate-tin solution, there is no such thing as an optimum anode

current density unless the free caustic and temperature are also specified.

As to the sensitivity of the bath, with regard to the composition of the deposit, the author does not tell us the end use of the parts, and it is, therefore, difficult to determine how critical the zinc content of the deposit would be. In our experience, it would be hard to find a case where a variation in zinc content of a few percent one way or the other from the optimum of about 22% would be of any significance whatever. Obviously, if it is considered important to hold the zinc content of the deposit at 22.0% plus or minus practically nothing, then the process becomes so critical as to become unworkable. In practice, such a condition is never the case and the zinc content can be allowed to vary from 15-30% without changing the deposit characteristics very much; thus, even the extreme variations quoted by the author would be of little significance, especially if the one lowest value is omitted.

It should be admitted that the views which we are putting forward here are based on experiences with the potassium rather than the sodium bath. However, we believe that the same general type of arguments hold for both systems.

It is not, of course, our intention to discredit the very excellent practical experimental work reported by the author, but rather to place a somewhat different emphasis on his conclusions.

Sincerely yours,

F. A. Lowenheim,
Supervisor Electrochemical
Research, Metal & Thermit
Corporation,
Research Laboratory
Rahway, N. J.

WHY DON'T YOU PUT SOMETHING IN THAT EMPTY CORNER?

THAT'S WHERE WE USED TO KEEP OUR NUBBIN BARRELS. I'M GOIN' TO ASK THE BOSS FOR MORE MONEY. HE'S ALWAYS TOLD ME SPACE IS MONEY, NOW THAT I'VE GOT THE SPACE CLEARED OUT MAYBE I CAN GET MORE MONEY FORTH' SPACE!

SCHAFFNER MFG CO.
EMSWORTH
PITTSBURGH 2, PA.
Phone - ROsewood 1-9902

WRITE US TODAY FOR FREE NEW CATALOG AND SAMPLES -

SCHAFFNER MFG. CO., PITTSBURGH 2, PA.

HAVE YOU TRIED SCHAFFNER'S NEW NO-NUBBIN COMPOUND YET? IT'S THE BEST ANSWER FOR THOSE PROBLEMS THAT NUBBINS BRING ABOUT. **FREE!** WRITE ON YOUR LETTERHEAD FOR OUR NEW CATALOG, SAMPLES, & HANDY BUFF N' POLISH CALCULATOR